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ABSTRACT

This document contains the papers on the PT3 (Preparing Tomorrow's Teachers to use Technology) program from the SITE (Society for Information Technology & Teacher Education) 2001 conference. Topics covered include: modeling instruction with modern information and communications technology; transforming computer coursework for preservice teachers; facilitating teachers' design of engaging learning environments; an embedded approach to faculty technology development; providing for higher education faculty professional development; infusing authentic, content-based technology during teacher preparation; collaboration of preservice and inservice teacher to integrate technology into a K-8 classroom; hypergroups as a community-building tool; assessment of technology skills and classroom technology integration; models of technology diffusion at public universities; technology standards for preservice teachers; preservice teachers and children working together at the computer; online discussion as a catalyst for metacognition by students and professors; effects of World Wide Web pages design instruction on the computer self-efficacy of preservice teachers; change as the constant in creating technology-rich learning environments; Maryland technology outcomes and performance assessments for the beginning teacher; using technology-rich cohorts for training teachers; scoring preservice teachers' electronic portfolios; using a course management system in the mathematics classroom; models, mentors, and mobility in a teacher education program; electronic portfolios as a capstone experience; interactive environments for university faculty, inservice, and preservice educators; teaching in the information age; technology-rich education for tomorrow's teachers; technologically enhanced cornerstone courses; use of development teams in problem finding; mentoring collaboration to integrate technology in the science curriculum; critical approaches to technological literacy and language education; evolution of an online data acquisition systems; energizing teaching to empower students through emerging technologies; faculty technology coaches; bootstrapping online organizational knowledge; using a survey to design and evaluate professional development activities; coexistence of technology and healthy active lifestyles; working

with urban schools across the digital divide; rethinking teaching and learning in the age of the virtual classroom; developing techno-savvy English language arts teachers; a technology consultant model in a project-based preservice teacher education program; resources to promote visual communications; faculty development as an agent of technology change; meeting the accountability challenge electronically; high touch mentoring for high tech integration; technology camps as catalysts for increased technology integration; integrating technology into science instruction; faculty mini-grants; preservice teacher responses to the restructuring of the traditional educational computing course; state-wide collaboration among three PT3 grant recipients; and collaborative action communities for preservice technology integration. Most papers contain references. (MES)

PT3 PAPERS

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The year 2000 continued the unprecedented trend toward stakeholders from PreK-16 education, the community, business, and government joining forces to reconfigure teacher education to include the intelligent use of technology by our future teachers. Sparked in large part by the Preparing Tomorrow's Teachers to Use Technology (PT3) grants awarded by the Department of Education, this trend was additionally supported by national initiatives in standards, reform, and research with an eye toward sustained change through the use of technology in teaching and learning. Traditional educational methods and structures are being been challenged: past era practice is not sufficient for 21st century learners.

In the first two years, the PT3 program awarded over 250 grants to consortia nationwide. Along with the groundbreaking innovations and organizational changes that grantees undertake, they are further charged to disseminate findings and practices to fellow grantees, peer institutions, and the general public. A dedicated PT3 section in these SITE Proceedings, representing over 60 institutions, is a testament to the diligence of these consortia to share their knowledge, successes, and challenges so that others may learn.

The initiatives highlighted in this section describe more than successful courses or innovative individuals. Experience has shown that such isolated change will wither in the long term without transformed assumptions about learning, shared visions of success, and committed wholes, from the top administrator to the novice student. Due to the exceptional volume of entries in this section, individual papers will not be introduced; rather, general trends have been used to organize the selections into categories: Design of Model Programs, Restructuring Existing Technology Courses, Faculty Professional Development, K12/University Partnerships, Electronic Portfolios, Online Tools, and Video-Based Resources.

Design of Model Programs

A great number of the PT3 grantees are progressing through their first year of funding, while the rest are well into their second year. Not only are the authors of these papers able to describe the components of their model designs, but many can now also give advice on early implementation. One project, for example, details a training model for preservice teachers. Another utilizes the three components of faculty development, technology-enabled field experiences, and a digital portfolio system. A third makes use of four tools: classroom mentoring, mini-grants and stipends, innovative training formats, and K-6 to university modeling. A field-based model that provides preservice teachers with supported opportunities to use instructional technology in authentic classroom settings is detailed. At least one paper focuses on efforts to incorporate technology proficiencies into teacher preparation, and two in particular describe the elements of systemic change spurred by their projects. Other grantees present strategies of modeling and mentoring for effective technology use. A final paper in this section comments on the larger implications for such program improvements in teacher education programs across the country.

Second-year projects have submitted papers that address their first-year evaluation results. Authors describe faculty attitudes toward the inclusion of technology within teacher education courses, qualitative and quantitative results demonstrating positive results gained over the first year, the components of program implementation, including pre-planning, roles and responsibilities, and management tools, and the processes, instruments, data collected, and lessons learned on the way toward a technology-rich and sustainable teacher education program. Clear in many of the papers in this section is an honest appraisal of the

difficulties inherent in the technology training process, with practical suggestions for project implementation in other settings.

Restructuring Existing Technology Courses

How to best prepare preservice teachers to meet the challenges of technology-integrated learning stands as one of the major concerns within the PT3 grant program. Many grant recipients have agreed that the traditional educational computing course seems to no longer suffice. Accordingly, universities have developed innovative approaches to restructuring the traditional course format. New models, successes, and student responses to these changes are shared in these papers.

Faculty Professional Development

A clear theme emerging from this selection of writing is the focus on developing the technology skills integration abilities of faculty, although the strategies for faculty development are broad in range. The four broad categories of faculty support cited in one report are reflected throughout this section: faculty release time, frequent meeting to share successes and challenges, workshops and training sessions, and ongoing support. One project used data from a questionnaire to design and evaluate computer support services and training workshops, as well as to help individual professors to design professional development plans. Another provided resources for methods faculty to revise courses and model technology integration, while a third used a mini-grant process to enable faculty to change syllabi, take training courses, and collaborate with technology-trained K-12 faculty. Supporting faculty for the long term in their efforts to experiment with ways to use technology to change and enhance their teaching was key in the majority of papers.

The methods of instructing faculty on technology skills described in these papers come in all forms, from a three-day technology camp for faculty, K-12 teachers and teacher education students to a week-long "technology chalkboard" program within a smart classroom to four month intensive faculty training period to develop technology-enhanced lessons. Faculty work with technology fellows or coaches in two projects to provide "just-in-time" instruction, and even taught one another technology skills in another.

PreK-12/University Partnerships

The end result of all PT3 efforts is to see technology being successfully integrated in schools. To further this effort, many universities have used their grant monies to fund partnerships with school districts. Benefits are reaped by all participants; preservice teachers have the opportunity to implement their technology skills in a real world environment, school districts receive equipment, training, and other resources from universities, and in-service teachers have access to the latest technologies and teaching strategies for their classrooms. The main benefactors, however, are the students whose needs are met by the collaboration and cooperation of so many on their behalf.

Electronic Portfolios

As artists use portfolios to select and demonstrate the best products of their craft, teachers can use electronic portfolios to demonstrate their proficiency to a far greater degree than is allowed by a single observation. In addition to being used as evaluation tools for pre-service and in-service teachers, portfolios are also used as a self-assessment tool. Reaping the greatest benefits from this powerful technology requires intense planning and learning from others' experience. Provided within these papers are discussions of necessary technologies, advantages and disadvantages, and various models of portfolio implementation which will guide the broader application of these tools.

Online Tools

The projects described in this section not only position technology as the focus of instruction for their preservice teachers, but also utilize technology tools for data management, communication, and curriculum design. A university-based project using an online data collection system reports on the pros and cons of the system. Another partnership tells of the use of a technology-based curriculum design software used by faculty and teachers to quickly align curriculum with state accountability guidelines. Two groups describe online communication tools, one using course-related online discussions to gauge students' learning and disciplinary thinking, and another building community and facilitating group problem solving among preservice teachers and faculty through participation in online discussions. The development of an interactive website for faculty and teacher education students is the focus of one paper, although the majority of papers in this section describe some extent of web presence.

Video-Based Resources

Advanced technologies such as streaming video are being developed to bring authentic classroom experiences into the college methods course and serving as the instructional medium for students at a distance. Visual communications artifacts for teacher education are detailed in one paper. Another project discusses the challenges of developing a streamed video collection of teachers using technology to be used online by teacher education students as examples of technology incorporation into content areas. Other papers in this section also make mention of efforts to develop video-based materials.

As evidenced by the variety of topics addressed in these papers, the PT3 grants have engendered innovative

plans and creative responses from universities and organizations across the country. A forum such as SITE 2001 allows solutions to be shared, ingenuity to be recognized and partnerships to be formed. Recognizing that we stand at the threshold of promising developments and understandings within a complex topic, the papers contained in this section serve as foundations upon which the larger goal of technology integration will be based.

Modeling Instruction with Modern Information and Communications Technology: the MIMIC Project

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Abstract: This paper describes the MIMIC Project a U. S. Department of Education Preparing Tomorrow's Teachers to Use Technology implementation grant. In this project colleges of education at five Ohio universities are collaborating to increase the modeling of technology in pre-service teacher education. The underlying premise of the partnership is that teachers teach as they were taught. As such, the partner institutions have developed a variety of processes where technology proficient educators mentor university faculty on the integration of technology into undergraduate teaching. The faculty in turn model best practice with technology in pre-service teacher education programs. Students enrolled in the pre-service teacher education programs encounter further technology modeling from cooperating teachers who have received technology training and the pre-service students are provided with opportunities to implement technology in field placements and student teaching.

Introduction

Teachers who integrate technology into their K-12 teaching on a regular basis are still in the minority (OTA, 1995). Despite considerable cost and effort the potential of technology remains unfulfilled in the classroom. This unfulfilled potential is a major concern as questions regarding the efficacy of educational technology intensify (Stoll, 1995).

What makes the current situation increasingly untenable is that twenty years of inquiry into the barriers to technology use in K-12 classrooms have led to an understanding of many of the key obstacles. Dias (1999) has identified resources, teacher time, training, and support as critical to technology integration. As more school districts equip facilities with computers, software, and Internet access, issues regarding resources (hardware, software, and accessibility to technology) have given way to questions regarding the nature and quality of professional development (teacher time, training, and support) (Ohio SchoolNet, 1999).

Recent research has identified attitudinal impediments to technology implementation in K-12 classrooms. Prominent among these are teacher beliefs (Ertmer, Addison, Land, Ross & Woods, 1999), and their relation to the adoption of instructional reforms (Neiderhauser, Salem, & Fields, 1999). Technology

integration as a component of instructional reform requires that teachers change beliefs and practices. Neiderhauser et al concluded that traditional beliefs about schooling remain strong and stable. The question remains whether many classroom teachers are experienced enough with educational technology to alter their beliefs, and embrace the potential for technology in the classroom.

Historically, the call for higher education reform related to technology has emphasized the need for hardware and software, the development of basic technology skills, the creation of instructional materials and, more recently, connectivity to online resources. Indeed considerable funds have been expended in these arenas. However, the sufficiency of this approach to impact overall change is open to question as the teaching methods modeled in typical teacher preparation programs have changed little over the years. Faculty modeling of technology integration is crucial, but the probability of increasing technology modeling is low as incentives to reexamine methods of instruction are haphazard and resistance to change in higher education is extensive.

Why has teacher education reform been so difficult when the investment in and promotion of technology integration has increased dramatically? In part, it is because prior reforms discount the importance of what Lortie (1975) documented twenty-five years ago, "that teachers teach as they were taught." Despite the addition of equipment, instructional materials and basic skill development, novice teachers do not use technology appropriately because informed models of technology use are lacking or absent in their learning experiences. At best, there is little within teacher preparation programs to systematically encourage novice teachers to embrace technological innovations. More often, the unknowns associated with technology use discourage novice teachers from integrating technology into their teaching repertoires.

Possession of technological skills though necessary does not guarantee technology integration. Novice teachers must also have appropriate experiences and instruction throughout their pre-service preparation (Thompson, Hansen, & Reinhart, 1996). Teachers must also understand how to apply technological skills in a pedagogically sound manner. This pedagogical capability is a key premise for integration. According to Handler (1992) teachers must observe the use of technology in the instruction they experience if they are to perceive technology as an instructional tool.

The current task is to provide instruction in pre-service teacher education that models the integration of technology. With this approach novice teachers will have experiences that will encourage them to effectively integrate technology into their teaching – to teach as they were taught. To this end, the MIMIC project is based on the premise that faculty mentored in the use of technology will be more likely to demonstrate the integration of technology to their students.

Prior Efforts

There was a precedent set at Cleveland State University (CSU) for mentoring faculty during the 1980s when the College of Education (COE) initiated the Visiting Instructor Program (VIP), a practitioner guided mentoring program. This popular and successful program recruited master teachers from area schools. The teachers were afforded COE faculty status during a one-year appointment and team-taught methods courses with COE faculty. The unanticipated consequence of this mentoring program was that the COE faculty was led to reevaluate the teacher education program and to revise it to reflect the realities of the classroom of the 1980s. Co-mentoring associations developed during the VIP program are still in existence today.

Design of the MIMIC Implementation project was also influenced by experiences gained from a one year Capacity Building grant (Abate, 2000). Practices that proved successful during the Capacity Building year were continued in the Implementation project. Primary among the successful practices were the use of classroom professionals as mentors for higher education faculty, the involvement of both College of Education and College of Arts and Sciences faculty, local decision making, and the application of standard evaluation materials.

Five Cleveland area colleges of education (Cleveland State, Baldwin-Wallace College, John Carroll University, Notre Dame College of Ohio, and Ursuline College) participated in the Capacity Building project. Acknowledging that each of the participating teacher preparation programs faced different technology integration challenges, the partners developed a plan to facilitate autonomous and flexible local management by each institution while promoting an exchange of ideas and solutions across institutions. Despite programmatic differences, all of the partner institutions were guided by a commitment to prepare education students to integrate technology in K-12 teaching.

As a result of the partnership plan, each institution recruited individuals best suited to meet its specific educational technology challenges. The majority of recruits were classroom teachers, but some were retired classroom teachers, school administrators, and even pre-service teachers with technology backgrounds, to mentor their higher education faculty and cooperating teachers. All mentors were designated Master Classroom Teachers (MCTs). They held Ohio SchoolNet training certification, or the equivalent, and were regarded as outstanding classroom teachers or potential teachers. They provided the higher education faculty with a host of technology integration experiences through one-on-one personalized mentoring. The influence of such able mentors in educational methods and selected Arts and Sciences courses increased pre-service teachers' awareness and understanding of technology use in the context of their teacher preparation courses. Technological solutions were modeled that reflected the kinds of technology problems faced by teachers in today's classrooms. Furthermore, in their role as mentors to the faculty, the MCTs had direct input into the ongoing shape of the courses and related field experiences. Several of the MCTs participating as mentors have indicated a willingness to serve as cooperating teachers for pre-service teacher field experiences, thus extending the impact of the project to future students.

Having someone to interact with that successfully uses technology in the classroom proved advantageous to both higher education faculty and the pre-service teachers. The curricular modifications and the development of technology-infused teaching strategies that the MCTs sparked during the Capacity Building year led to major modifications in higher education classroom instruction.

We just burned a CD-ROM of pictures I had from Antarctica and tropical rain forests for my Geology 101 class. I can now present to the whole class with out having to deal with slide trays and projectors. My mentor is encouraging me to make duplicate copies of the CD-ROM so we can make them available for student use. (Heather Gallacher, The College of Arts and Sciences, Cleveland State University)

The benefits of course modifications will remain on the campuses for future student populations. As such, even in the Capacity Building year the MIMIC Project was institutionalizing the integration of technology into teacher preparation courses. Applying the ISTE standards the MCTs were encouraging the higher education faculty and pre-service teachers to model learning strategies that involve more student interaction, more connections among schools, more collaboration among teachers, and more emphasis on technology as a learning tool.

My MCT teaches English/language arts in an urban setting. We view technology as a means for supporting best practice in integrated English/language arts methods. Careful revision of my syllabus has resulted in technology -supported assignments including use of the Internet for exchanging teaching ideas and establishing local and national professional collaborations via learned society Teacher Exchanges. I consider my MCT a teaching partner, and with her support I am changing my vision of meaningful technology implementation in integrated English/language arts. (Kathleen Benghiat, The College of Education, Cleveland State University)

In addition to the work of the higher education faculty and their MCTs, assistance provided by the MIMIC educational technologists helped teachers implement technology in their classrooms. This mentoring and support had a profound impact.

This year, our pilot program is bringing technology assistance to 14 teachers at St. Thomas Elementary School, an urban, Catholic school in the Hough area. Without the support of the capacity grant, the faculty would not have the ability to prepare the classroom teachers to model technology for their students. Jennifer Merritt, The College of Education John Carroll University

Overall the Capacity project provided a foundation for a full implementation. Students at all levels benefited from the effective modeling of technology in the classroom

Implementation Project Design

A consortium consisting of faculty from Cleveland area colleges of education including Cleveland State University, Baldwin Wallace College, John Carroll University, Notre Dame College of Ohio, and Ursuline College, developed the MIMIC implementation model. Three interrelated activities serve as the foundation for this model:

- Higher education faculty members are mentored in the meaningful integration of technology into their teaching. The higher education faculty in turn model this instruction for pre-service teachers;

- Professional development in basic technology integration in specific content areas is provided to K-12 schools identified by partner institutions. In particular, schools which routinely accept and support pre-service teacher field placements receive support; and
- Materials produced by the project are disseminated to local, regional, and national audiences.

Implementation Mentor and Faculty Format

As in the Capacity Building project, each of the MIMIC partners is recruiting the assistance of technology proficient MCTs. Local needs at each partner site, including the individual needs of each faculty member being mentored, dictate the recruitment of MCTs. The goal remains the same at each site: to mentor higher education faculty and advance practical insight into the integration of technology in pre-service courses. The mentoring relationships are markedly different from traditional training in educational technology. In MIMIC mentoring, each faculty member has a partner to interact with on specific needs and areas of interest. The mentor, who is typically a classroom professional, affords a bridge between theory and practice. The MCTs bring authenticity to pre-service programs by introducing solutions to "real world" technology problems faced in today's classrooms.

In their role as mentors to faculty, the MCTs have direct input into the ongoing shape of the courses and clinical supervision of related field experiences for teacher preparation. The curricular revision and the development of technology-infused teaching strategies that the MCTs introduce lead to modifications in university classroom instruction. The benefits of those modifications remain on campus for future student populations. As such, the influence of the Implementation Project extends beyond the individual mentor pairs.

The MCTs apply ISTE standards to further what research supports about how students learn best. The MCTs encourage the higher education faculty and pre-service teachers to model learning strategies that involve more student interaction, more connections among schools, more collaboration among teachers, and more emphasis on technology as a tool for learning. On their return to their classrooms, these teachers provide the project with a unique pool of educators who will then participate on a continuing basis as supervising teachers.

Faculty Participants

Across the five participating campuses there are many college of education faculty members interested in augmenting their teaching repertoire with the integration of technology. Since the inception of the Capacity Building grant, numerous faculty members have become involved in the project. Recruiting college of education faculty is a straightforward task as the number of volunteers exceeds the number of available openings. One limiting condition for selection is that college of education participants must be responsible for teaching pre-service methods or foundation courses. In addition, a limited number of positions are reserved for faculty indicating a desire to participate for more than one year of the project. The logistics of recruiting Arts and Sciences faculty is more complicated. In order to have the greatest impact on pre-service teachers, only faculty members responsible for teaching Arts and Sciences courses required within general pre-service programs are recruited for the MIMIC implementation project. Target numbers for Arts and Sciences faculty involvement are set by each institution.

Together with the MCTs the Faculty assume the following responsibilities:

- Review best practice with technology in their content area with the educational technologists;
- Examine the syllabi of courses to detail technological activities suitable for inclusion;
- Work with MCT mentors to integrate technology into the identified courses;
- Review the ISTE NETS with educational technology faculty;
- View videotaped technology-rich lessons for use in methods courses;
- Where necessary learn the basic use of specific technologies;
- Team teach in undergraduate courses;
- Participate in the development of instructional resources; and
- Develop descriptive accounts of processes for dissemination.

Cooperating Teachers

Every year hundreds of northeast Ohio K-12 teachers serve as cooperating teachers, opening their classrooms and providing guidance to pre-service teachers fulfilling their field experience requirements. In the Capacity building MIMIC Project, educational technology faculty from the participating institutions mentored small numbers of cooperating teachers to assist them in the development and implementation of technology in their teaching. Creating a widespread impact on teacher modeling with technology via this approach, though successful, is not feasible. For example, even though these cooperating teachers may receive student teachers, practicum placements, and field observations, the total number of students they will encounter is very low when compared with the time and effort expended in mentoring. In addition, all of the cooperating teachers who were mentored across all of the institutions entered the mentoring activity at a very basic technology skill level. The majority of the time spent mentoring was geared to developing basic technology skills. More traditional inservice workshops can achieve the same results with a greater number of cooperating teachers serviced. For this reason, the Implementation project replaced mentoring with cooperating teachers with professional development workshops. The professional development differs slightly from traditional educational technology training in that it is offered to content based teams rather than school based teams. As content based technology training it focuses on Implementation details as well as basic skill development.

Project Evaluation

Implementation project evaluation activities address both formative and summative evaluation questions that examine the validity and impact of the project. A comprehensive sequence of evaluation activities is implemented to insure that the goals proposed by the MIMIC Project are addressed satisfactorily. A monthly review is used to track project activities and to verify that planned activities occur as scheduled. Progress notes are recorded and used to modify planned activities. Surveys are administered to identify the technology proficiency of higher education faculty and supervising teachers. Information collected from the survey is used to tailor mentoring and instructional activities. End of the year surveys comparable to previously mentioned surveys will be administered to furnish a pre-post picture of faculty and supervising teacher skill development.

Mentors prepare an implementation plan for each faculty member and maintain notes on support provided. This qualitative data is used to modify mentoring plans. A pre-post review of syllabi developed by participating faculty members and supervising teacher logs of technology activities implemented offers qualitative data that will document technology use by participants.

Dissemination

A prototype web site (http://mimic.ed.csuohio.edu) dedicated exclusively to the implementation of technology by novice level technology using teacher educators was developed in the Capacity Building year. Content on this site is revised periodically, and selected outside reviewers are currently testing the site.

One of the primary roles of the MIMIC project coordinator is to increase dissemination of the MIMIC Project by reporting project efforts, editing papers for submission, and assisting in the development of faculty presentations. This added attention and support by the project coordinator dramatically increase the availability of information on modeling technology in teacher education programs.

To encourage involvement in the project faculty participants are provided travel funds to report on lessons learned the MIMIC Project at regional and national conferences. During the spring of each year the MIMIC project will host an Urban Colleges of Education Technology Summit. The focus of the summit is on preparing pre-service teachers who will teach in urban settings to integrate technology into their teaching. Proceedings from this summit will be disseminated through the Internet and traditional publication sources.

Conclusion

The MIMIC Project began in the fall of 1999. To date the project has recruited Master Classroom Teachers, paired these MCT's with university faculty, and together they have developed individual mentoring

plans. Monitoring and evaluation of participant interactions is ongoing and feedback has been provided to participants. E-mail has been used extensively to promote community and to serve as an example of modeling of technology integration. A web site designed by the MIMIC team and local classroom teachers is currently under development. K-12 teachers who model technology in their classes have been recruited for the purpose of developing videos that exemplify the integration of technology in the classroom. The long-term success of the MIMIC project is dependent on the active participation of the mentor-faculty dyads. As such, emphasis has been placed on supporting participant control over project activities and minimizing administrative requirements. To this end, the project team has simplified recorded keeping, provided technical support, and kept physical meeting to a minimum.

As participant interactions increase, the mentor-faculty dyads will document the successes and failures of the school-based learning, work-based learning, and connecting activities implemented. Management of the project will be revised based on this documentation. Finally, indications at this point are that both classroom teachers and university faculty are reacting favorably to the mentoring arrangement and more importantly that the university faculty are starting to integrate technology into their teaching.

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Transforming the Face of Computer Coursework for Pre-Service Teachers – A Working Model

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Abstract: Prior to Fall 2000, the College of Education at the University of Houston, required its undergraduate education majors to enroll in a three-hour course, CUIN 3312, "Information Technology for Young Children." The original one semester course was divided into three one-hour courses spanning three semesters. The elimination of prescribed assignments is a major change in the requirements for the newly structured technology course. In the new model, technology assignments support required education course activities, thereby demonstrating through practical applications how technology should be integrated into classrooms. Education professors are beginning to restructure their course requirements to allow for increased technological use. Students are searching out ways to meet course requirements using technology even when they are not specifically required to do so by their professors. Early indications are that this model may in fact fulfill the intent of the restructuring effort.

Like most universities, prior to Fall 2000, the College of Education at the University of Houston, required its undergraduate education majors to enroll in a three-hour course, CUIN 3312, "Information Technology for Young Children." This class taught instructional technology applications through pre-determined assignments that focused on learning basic computer applications. This course was generally effective; however, some faculty perceived a need for the technology course to be integrated with the students' required education courses. Handler and Strudler (1997, p.16) assert that pre-service teachers "often do not have the opportunities to apply what they have learned in their other classes and field experiences." There was a shared value among our faculty that the classroom training of pre-service teachers should use technology that was aligned with methods instruction and include active self-directed learning experiences. The vision was for students to learn technological skills and apply to the assignments required in their education classes. It was thought that this approach would better prepare them to use technology both in the performance of professional tasks and as a teaching and learning tool in their future classrooms. The faculty in the Instructional Technology program applied for and received a grant through the "Preparing Tomorrow's Teachers to use Technology" (PT3) program. The grant provided funds for changing the way technology was taught and applied in the undergraduate education program at the University of Houston.

Following the proposed project design, the original one semester course was divided into three one-hour courses spanning three semesters. This provides students with technological support throughout their upper-level coursework and student teaching experience. The new model allows for a continuous

learning process over a longer period of time, intended to result in students developing stronger skills and having more opportunities to apply those skills in real world scenarios.

The elimination of prescribed assignments is a major change in the requirements for the newly structured technology course. In the new model, technology assignments support required education course activities, thereby demonstrating through practical applications how technology should be integrated into classrooms. Objectives for the new technology course are based upon the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS). Course objectives require that students demonstrate mastery of at least eight of the twenty-four ISTE indicators during each of the three semesters. Grading criteria for the new course includes attendance, demonstration of at least eight ISTE indicators, and participation both in class and in regular on-line discussions. In order to implement these revisions to the technology course format, lab instructors meet with education professors to learn about their course assignments and investigate how those requirements can be met through the use of technology.

On the first class day, the new course model was introduced to the pre-service teachers, and they began brainstorming class assignments that could satisfy ISTE indicators. The students also recognized how course assignments using technology would enhance their teaching portfolios, a requirement for graduation and an important asset during interviews. Supported by the findings of Hirumi and Grau (1995, p.14) that "teacher education programs that cover a limited number of prescribed computer proficiencies at a set pace and sequence may leave many educators unsatisfied and frustrated with their training," the new class format is driven by students needs and is based on individualized learning activities. The technology instructors pre-assess students on their basic computer and Internet skills in order to plan effectively. Currently, instructional formats include large group presentations, small group workshops, and independent learning activities. Participating pre-service teachers have collaboratively developed a reflection format that accompanies their individual projects and allows them to articulate their mastery of ISTE indicators. In addition, students have developed a grading rubric that instructors use to assess the reflections and finished projects. Lab instructors have provided assistance to students in locating resources necessary to meet those ISTE standards that are not evident through part of required tasks in their education classes. These include the investigation of such materials as online grade books, forms of assistive technology, and information on copyright issues and acceptable use policies.

During the first semester, stakeholders have responded favorably to the changes in the course. Education professors are beginning to restructure their course requirements to allow for increased technological use. Some professors have actually changed their syllabi to incorporate more technologically based assignments. Lab instructors are developing workshops to strengthen application skills for both students and professors. Students are searching out ways to meet course requirements using technology even when they are not specifically required to do so by their professors. The online hypergroup, a format for ongoing communication and collaboration, is supporting the evolution of a learning community among the participating pre-service teachers. Through this medium, students share ideas regarding their course assignments and research efforts. While applying new technological skills in their class presentations, students inspire their peers to learn new applications. Early indications are that this model may in fact fulfill the intent of the restructuring effort. Future study of implementation and outcomes will continue to better determine the impact on the skills of pre-service teachers in the use of technology as an integrated instructional tool.

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Trek 21: A PT3 Project to Facilitate Teachers' Design of Engaging Learning Environments

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Abstract: The goal of Trek 21 is to prepare educators to use and integrate instructional technologies (IT) for teaching and learning. This paper reports on outcomes resulting from the first-year implementation of a 3-year model of IT integration – a collaborative process for developing sustained, systemic changes in teaching, using a year-long cycle of on-going professional development and analyses of data designed to inform these changes. Baseline findings profiled K-12 participants as preferring a teacher-centered approach, providing minimal written details in lesson plans, and depicting themselves with a low level of computer use, and low use and integration levels of instructional technology. Teacher change from 3-week summer institutes included (1) improvements in skill, comfort, and confidence with ITs; (2) increased awareness on how IT use changes student and teacher participation; and (3) increased motivation in IT integration after seeing improvements in students' own motivation to a different teaching approach and involvement.

Introduction

Current instructional technologies afford student and teacher access to information and multiple modes of knowledge construction. By design, these new technologies make this method of knowledge construction largely individualistic and demand changes in the teaching and learning environments where they are truly integrated into the instructional process. New teachers (pre-service) cannot develop new perspectives on instructional design and new instructional technology skills outside of settings and environments in which these approaches are modeled. Students exiting teacher preparation programs must include experiences to integrate new and future instructional technologies and develop the skills necessary develop appropriate teaching environments where limited technology infrastructure and capacity exists.

Recent recommendations by the National Commission on Teaching and America's Future claim that the single greatest likelihood of impact on student learning is the education and professional development of pre-service teachers. The report's assertion that pre-service teacher education has the potential for the greatest influence in enhancing the learning opportunities of children requires bringing together the contexts of schools with the preparation of teachers. This preparation must be adequate and sustained in the professional practice of teachers such that schools become the leader of this transformation rather than merely a participant, or worse a trailing, incidental, disaffected subject of the transformation.

Technology integration must be embedded in the work of teachers and in the preparation of teachers (Darling-Hammond, 1994). Technology becomes not just a tool, but an engine in the transformation of schools. To insure such transformation, teachers must be the agents, not the recipients, of the technological shift. The integration of teacher education must be an endeavor located in the complete system that affects the quality of teacher preparation. This partnership requires that we view teacher education as more than a linkage of partners who use technology in isolation. Teacher education would be a "place" that engages all contexts vital to successful teachers in one shared, professional culture. Public school and university professionals at the in-service and pre-service levels would provide the knowledge base for technology integration critical to successful teacher practice and the highest quality learning for children. The goal is not just a set of experiences, but rather the creation of a professional culture where pre-service students are engaged in settings at the university and in schools where the best integration of technology in teaching practice is modeled *systemically.*

Teacher Preparation Program

The Benedum Collaborative at West Virginia University is a 5-year teacher education Professional Development School-based program that is attempting to build a professional culture in a partnership. This partnership includes 5 West Virginia school districts, University partners and 21 Professional Development Schools in an effort to renew public schools and teacher education. A core element of the new program is a technology strand, developed to help university faculty and PDS faculty in the integration of instructional technology as they participate in the pre-service teacher education process. These teaching and learning environments engaged in instructional technology provide pre-service teachers opportunities to experiment with technology integration and to re-examine their roles as teachers in a technologically enhanced classroom.

Project Design

The Trek 21 model of teacher preparation and professional development includes *Host Teachers* in West Virginia's statewide Professional Development Schools (PDS), faculty from the College of Human Resources and Education (HR&E), and student interns in their 5th year of WVU's teacher preparation program. Trek 21 looks to impart lasting change in the culture of teacher practice. When effective modeling and integration of instructional technologies occur, new teachers entering the profession meet with success. To accomplish this, the design of the Trek 21model includes the following series of professional development events.

Summer Institute: Three-week technology integration summer institutes for PDS Host Teachers and a two-week technology integration summer institute for university faculty initiate each year of the *Trek 21* project cycle. These institutes address genres of instructional technology applications (Harris, 1998), targeted technical training, and the preparation of instructional technology materials and resources necessary for immediate integration into classroom instruction. Teachers develop a web-based instructional unit, which they implement in the fall with the pre-service student intern.

Continuity Meetings/Site Visits: Following the summer institutes, *Trek 21* holds site-based continuity meetings with PDS faculty each semester to address issues related to the successful integration of instructional technologies at their location. Site visits occur throughout the year to provide continued support.

Semi-annual Mini Conferences: Each semester a mini-conference is held in partnership with the West Virginia "Technology, Teacher Education, Tomorrow" (T3) non-profit organization to share best practices, receive technology enhancement training, and to deliver presentations of activities related to the integration of instructional technologies.

Assessment

Project assessment uses multiple forms of data, multiple roles and levels of participants, and at developmental stages that assess the impact of technology integration during and after project completion. This assessment strategy also provides formative assessment information to help the teacher education partnership meet national standards for teacher preparation and practice, including NCATE, INTASC, and the National Board for Professional Teaching Standards. Both quantitative and qualitative methods of data collection are used for assessment, and serve as the foundation for evaluating the impact of this initiative to integrate technology into teacher education. All instruments and assessment of knowledge products are thematically consistent in evaluating the changing nature technology integration within classrooms, across schools, across faculty groups, and within the outcomes of the teacher education students' learning experiences and teaching practices.

Findings

The baseline assessment of this project incorporates multiple instruments that will assess the impact of technology integration after the project has completed. These instruments along with others described below will serve as the foundation for assessing the impact of this initiative to integrate technology into teacher education. All of these instruments are thematically consistent in assessing the changing nature of how technology is integrated within classrooms, across schools, across faculty groups and within the outcomes of the teacher education students' learning experiences and teaching practices.

Schools Climate Education Survey: This survey assesses four factors of change in school climate related to national standards and shared partnership beliefs. Two of these factors, "Professional Development Activities" and "Classroom Teaching/Learning Activities", are critical to our assessment strategy and will reflect the use of technology in PDS classrooms. Data gathering for this assessment is scheduled for May, 2001.

Pre-Service Teacher Survey: This survey assesses three factors of student teaching and other clinical experiences with reference to partnership standards and beliefs. Quantitative results from the instruments administered indicate K-12 and Higher Education faculty alike are predominantly at low use and low integration levels (42% and 47% respectively). Approximately 30% of faculty in each group could be categorized as intermediate, and the remaining split fairly equally between experienced or beginner stages. As these are pre-training assessments, effectiveness of training will not be available until the September of 2000 following evaluation of Trek 21 summer institutes.

Concerns-Based Adoption Model: This instrument (Hall & Louck, 1978) describes and assesses teachers' transition through 7 levels of concern that they may experience as they implement a change or innovation in teaching. The survey tracks their levels as they adopt and/or implement the new practice. Findings indicate that the PDS Institutes were effective in addressing participants' internal concerns as reflected in decreases in eight of twelve pre/post-test I comparisons. The Institutes had limited impact on any external stages of concern.

Learning Strategies Survey: The *Learning Strategies Survey* contains items that assess teachers' perceptions of practice in their own classrooms. The Likert-scale ranges from "always" to "never" and applies to questions that ask teachers to reflect on the nature of their teaching practices. PDS participants preferred a teacher-centered approach. Looking at individual factor scores, a small number of participants' scores slightly exceeded the mean norm. For Learner Centered Activities, four respondents exceeded the group mean; for Assessing Student Needs and Climate Building, seven respondents exceeded the group mean; and for Participation in the Learning Process, two respondents exceeded the group mean.

*Self-Evaluation of Basic Computer Use:*This rubric assesses the level of achievement that teachers self-report according to a set of computer competencies. Teachers are asked to rate themselves across three rubrics of computer use: 1) basic computer use; 2) advanced computer use; 3) teacher Internet use. Each of the rubrics has four levels; Beginner, Low Level User, Intermediate Level User, or Experienced User. A total of 44 teachers responded across all three Institutes and rated their level of computer use; 6% (3) of the 44 teachers related their ability to be an Experienced User, 30 % (13) rated their ability as Intermediate Level User, 50% (22) rated their ability as a Low Level User, and 14% (6) rated their ability as Beginners.

Lesson Plan Assessment: Teachers submitted paper-based lessons for IT integration. Complete lesson plans included learning outcomes, state standards, materials, procedures, and assessment. Analysis of these lessons revealed that 38% (18) of the 47 teachers did not submit a lesson plan, 32% (15) submissions included some features of a lesson plan, and 30% (14) of the teachers submitted a complete lesson plan.

PDS Summer Institutes

During each summer institute teachers were asked to respond daily to questions regarding the content and quality of training. Two batteries of questions were asked: Likert-scale, forced choice and open-ended response.

Likert-Scale Items: Overall the summer institute training had a positive impact on understandings of the project, the process of planning for IT integration and the use of the ITs used in the training agenda. The training also had a positive impact on participants' level of confidence that they would use the skills and the ITs would be included in future training. Faculty members from the Professional Development Schools were less likely to be familiar with storyboarding than were faculty from the College. Overall, the impact of the training on the HR&E faculty was less. Sessions where only ITs were introduced without hands-on application did not exhibit significant impact. Participants indicated that they were less confident in using ITs in their units.

Open-Ended Questions: Responses to open-ended questions were categorized as opportunities, expectations and engagement, impacts on intern, and impacts on students.

Teachers stated that it was nice to have time set aside to develop and work on units, as schedules during the school year were often prohibitive to the opportunities afforded by the Summer Institute. Similarly, teachers noted that traditional technology training focused on the development of skills, but the Institute provided strategies and support for integration of the technology into actual units. The majority of teachers mentioned the opportunity for one-on-one assistance and hands-on application.

Most teachers stated that expectations for the Summer Institute needed to be made clear from the outset. How the Institute was to be organized, the level and duration of commitment expected of teachers and what the teachers were to produce were areas the teachers stated needed clarification.

Several teachers emphasized that use of language was a source of confusion with regard to expectations. Teacher and trainer understandings of what constitutes a "unit" and what is a "lesson" appeared to teachers to be different. The use of vocabulary surrounding the technology (lingo and jargon) by trainers raised levels of expectation of computer literacy.

Many teachers commented that their skill and comfort levels with technology and integration had increased throughout the Institute. Teachers noted that the kinds of technology presented were pertinent to their teaching situations in the classroom and therefore the training was motivating. Several teachers also mentioned that the increased integration of technology into units would increase student motivation and engagement. They stated that engagement, not just increased learning opportunities was a worthwhile goal.

A majority of teachers were excited to share with their interns what they had learned. They saw themselves as able to model IT and to "encourage them to use technology as a teaching tool." Citing increased comfort levels with technology teachers also planned to help the interns develop their own units and lessons.

Teachers also stated that they felt "ready" to teach their units and "excited" about what their students will learn. Some said that students would be exposed to new things, motivated and "will definitely benefit" from the IT units. Increased opportunities to use the computer and technology were other impacts that teachers cited.

Overall, teachers felt that the Summer Institute was a positive though "exhausting" experience. Several teachers stated that they were thankful to have the laptop, the training, the one-on-one help and the time to develop the units. "This [was] an intense 3-week institute, with additional work at home. However, the experience [was] really great! And rewarding. I really [appreciated] having this opportunity!"

PDS Site Visits

Generally, teachers reported that the implementation of the units was proceeding as planned, but that modifications based on time, content and student skill level were often needed. Some teachers stated that most difficulties arose from problems with equipment, especially hardware. Most teacher reported that, although more time-consuming, the IT unit had given them an alternative teaching strategy and had increased their own interest and motivation. Nearly all teachers said that students were more engaged, interested and motivated as a result of the technology integration. Other impacts were an increase of collaboration between students, "asking good questions," interest in doing relevant searches at home and increased satisfaction in "the finished product." Some teachers also noted the many new learning opportunities technology afforded students while a few regarded the computer as "managerial and teacher-focused; not items that related specifically to teaching." Teachers stated that intern involvement ranged from complete implementation (in the case of a sick teacher) to "secretarial duties" (e.g., entering rosters into Blackboard.com. Nearly all teachers expressed frustration at the delay of interns receiving laptops. One teacher allowed her intern to take her laptop home every night to work on a new unit while another intern was not afforded any type of "collaborative experience with the computer."

Continuity Meeting

Modifications. Teachers reported that they either had or planned to make modifications to their units (21/34) such as the following:

- Expand or add features
- Need to "fine tune" their units
- Forced to modify the timeline for their unit
- Make their unit more "student-centered"
- Change the types of technologies used
- Modifications based on students' abilities or needs
- Modifications based on "technical difficulties"

A few teachers (3/34) explained that they had not yet run their units and so were unsure if changes would be needed. In addition, several teachers (8/34) shared that they were satisfied with their units and had no immediate plans for modification. A few teachers (3/34) planned to amend other units or classroom activities by integrating technology.

Intern Involvement: Teachers reported that intern involvement (unit modifications and unit implementation) was often dictated by the *timing of placements*. Several teachers (8/34) reported that their intern had either not arrived, had completed placement before the unit was implemented, or had not been in the classroom long enough to participate. Teachers (5/34) also cited the delay in obtaining laptops for intern use as a barrier to involvement. Some (12/34) indicated a *high level of intern involvement* in unit development and implementation. Others (7/34) described a *less active intern role*—observing the host teacher integrating technology or providing one-on-one assistance as students interacted with technology, but not "teaching" with technology. Some teachers (20/34) indicated that interns *developed and integrated technologies at fairly high levels* when they arrived for their placements. "My intern used some parts of the unit, but had designed her own to use prior to starting this year." Teachers (7/34) described instances where they felt interns had *inadequate training* or where interns were not familiar with integration in the classroom.

Impact on Students: The majority of teachers (26/34) described increased *student engagement* as a result of unit implementation, particularly where students had "hands-on" opportunities: Teachers (13/34) described an *increase in learning* as an outcome of technology-supported instruction. In addition the "fit" between content and technology enhanced student opportunities to learn. Several teachers (4/34) commented on the *proficiency and ability of their students* to learn to use technology. However, teachers (5/34) also indicated that the impact would have been greater but for the barriers of lack of access to equipment and their own abilities to provide technology training for students.

Impact on Teachers: Increased confidence and comfort related to using technology personally and professionally was the most often cited (17/31) change when teachers were asked to "describe the impact you think the experience of developing and running your unit has had on you." Related to their increased comfort was a *perceived impact on their teaching*:

- Change in the activities they use
- Improvement in the quality of instruction
- Change in their role in the teaching process
- Increased their own engagement
- Awareness of other IT possibilities
- Increased motivation to learn
- More efficient communication and management
- Sense of themselves as resources

Teacher Units

The PI, IDT specialist and Special Education Specialist evaluated a total of 43 units (Table 1). The PI and IDT specialist passed a similar number of units, while the Special Education specialist assigned a passing score to a higher number of units, but identified only one exemplar unit. The PI and IDT specialist identified nearly the same number of exemplar units, but passed fewer units than the Special Education specialist. Jurors agreed on eight passing units, four failed units, and one exemplar unit.

Juror (units reviewed)	**Passed**	**Failed**	**Exemplar**
IDT (41)	18	13	10
PI (41)	17	12	12
SES (43)	30	12	1
Total Agreement	8	4	1

Table 1: Juror ratings of teacher-developed web-based and IT-integrated units.

The most frequent learning strategies employed by teachers were problem solving, concept scaffolding, and discovery learning (Table 2).

Learning Strategies	**Major IT Applications**
Problem Solving (23)	Information retrieval (8) Desktop publishing (5)
Concept Scaffolding (22)	Presentations (11) Information retrieval (5)
Discovery Learning (18)	Information retrieval (8) Internet searches (6)

Table 2: Juror ratings of teacher-developed web-based and IT-integrated units.

To support problem-solving teachers primarily used information retrieval activities and desktop publishing. Concept scaffolding was supported by the teachers' use of presentations and information retrieval activities. Discovery learning was supported by information retrieval activities and Internet searches. IT applications most utilized by teachers were presentations (32 activities), information retrieval (29), and Internet searches (17).

The most important IDT issue was lack of identifying the purpose and learning outcomes for each lesson on the unit home page. The web-based units were typically structured as teacher sites with a limited number distinguishing between teacher and student activity. Rich learning activities were frequently depicted in those lessons using traditional teacher-centered approaches; this was generally not true of IT-integrated student-focused activities. Some IT-based activities, such as chat rooms and web boards, lacked procedural details.

Web design issues identified included the following:

- Restructuring home page to communicate intent
- Descriptive titles for individual lessons
- A home page to structure the learning activities
- Less scrollable text or separate lessons pages
- Fewer animated GIFs
- Resolve background/text contrast problems
- Consistent use of navigation icons

Conclusions

Baseline findings profiled K-12 participants as preferring a teacher-centered approach, providing minimal written details in lesson plans, and depicting themselves with a low level of computer use, and low use and integration levels of instructional technology.

Results from 3-week summer institutes improved teachers' internal concerns with instructional technology. Limited impact on the external stages of concern may reflect the limitations of a three-week experience and the lack of opportunity for teachers to apply new skills and knowledge in their teaching. Teachers valued the time made available to concentrate on skill development and unit development. Teacher change can be cited as (1) improvements in skill, comfort, and confidence with instructional technology; (2) increased awareness on how IT use changes student and teacher participation; and (3) increased motivation in IT integration after seeing improvements in students' own motivation to a different teaching approach and involvement. Exactly how to design or orchestrate these changes in student engagement within the web-based units was tentative on the part of many teachers, which could have been partly due to learning how to use the software and laptop. Also, teachers' use of ITs were devoted to teacher-based presentations and Internet-based search and information retrieval activities. However, an important finding for this project was the majority of teachers (26/34) who were interviewed after implementation of their units reported that student engagement increased, particularly when hands-on opportunities were provided.

A major deficiency of our design was not being clear as to what we wanted them to bring to the institute, in terms of a "lesson," learning instead that a "unit" made more sense to them. We also learned that we need to be more clear of their role in their own professional development, not only what was expected of them during the institutes but afterwards. This was due to field-testing a new approach and the logistical learning we did during the planning and running of the Institutes as well as what it meant to assist teachers in changing their teaching.

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Contextual Levers: An Embedded Approach to Faculty Technology Development

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Abstract: While much has been written about the potential benefits of technology integration for teacher education, not all university faculty members embrace the process willingly. This paper describes efforts at the University of Rhode Island to create a unified approach to teacher education across disciplines that incorporates faculty technology development in routine practice. Through the use of standards of practice, an electronic student portfolio system, and the support of innovative practices through a PT3 implementation grant, the School of Education is attempting to integrate faculty technology training into the key aspects of regular operating procedures.

The School of Education (SOE) at the University of Rhode Island (URI), in conjunction with recent major efforts at the university level, is committed to the exploration of ways in which technology can change the nature of teacher education and classroom instruction. The discovery of potential benefits and innovative practices made possible by new technologies has become an integral part of the URI teacher-training program. While the standards to which teacher education programs are held include some acknowledgement of the potential benefits of educational technology, they focus much more on sound pedagogy and what could be termed the traditional aspects of teacher education. This has presented the faculty with the challenge of integrating technology to enhance the teacher education process while maintaining its more conventional elements.

Several authors (ISTE 1999; Wetzel 1993; Willis and Mehlinger 1996) raise questions about the value of the traditional "introduction to technology" course that is the hallmark of many efforts to include technology in teacher education. In such courses, technological tools are taught out of context. The instruction is skills-based, and is focused on the technology instead of curriculum content. To this end, URI faculty and students in the SOE are not trained specifically on the use of basic technologies in isolation from the teacher education curriculum. Instead, efforts are being made to encourage and support the use of technology by all stakeholders in their administrative, educational, and practicum experiences. The goal is to motivate faculty members to maintain a consistent effort to be knowledgeable about new technologies, as well as practical ways these technologies can be used to make the teacher education process more efficient and effective.

Faculty Participation

It is perhaps no surprise that not all of the members of the SOE faculty have embraced technology integration efforts at URI. Like faculty at many universities, they do not see the necessity of incorporating technology into both institutional and personal instructional systems that have worked for years without it. The focus of efforts to change faculty practice is on the development of a shared vision of how to move forward with the school's instructional program. Gaining group consensus in the process of technology

integration is consistent with much of the literature on the adoption of technology in higher education. One basic conclusion of this research is that people are the key to success; both the faculty and the administration must support the integration efforts in order for them to work (Anandam & Kelly 1981; Armstrong 1996)

Higher education faculty members are accustomed to functioning as experts in their particular fields, which can make it difficult for them to accept the role of learner that is often required when approaching new technologies (Brunner 1992). At the same time, forced acceptance of technology is ineffective (Bull & Cooper 1997). A shared vision (Falba 1997) of the role that technology plays in the mission of preparing teachers is crucial to success, and is key to the approach being used to move URI faculty forward in their use of technology. In agreement with Heuer, et al. (1996) and Kozma (1985), the faculty members have played an ongoing and vital role in the development of a revised program of study that embeds technology as an integral part of the teacher education process. This active role is not only key in ensuring that these efforts are more successful and long-lasting than individual labors, but also serves as a point of leverage for convincing professors and adjunct faculty of the importance of learning to use and integrate technology into their teaching and supervision.

Contextual Levers

URI's integrated approach to faculty development combines three elements to address the task from three different perspectives:

Beginning Teacher Standards

In recent years, the state of Rhode Island has moved to increase the rigor of its teacher education programs through the use of standards for all new teachers. The Rhode Island Beginning Teacher Standards (BTS) cover eleven areas of professional practice that one would expect to find as part of standard operating procedure for high-quality teachers (e.g., solid content and pedagogical knowledge, ability to foster critical thinking, classroom management skills, effective communication skills, etc.). In part, the BTS also serve as a quality control mechanism for the state. Institutions such as URI have an agreement with the Department of Education that allows the SOE to indicate when a student has met all eleven standards, at which point the state assumes that he or she is eligible for certification.

The SOE at URI has adopted these standards as a primary guide for the organization and implementation of its teacher education programs. The focus on the BTS has facilitated the coming together of all departments that train teachers under a set of common purposes, tasks, and evaluation criteria. The traditional resistance that is encountered when trying to achieve this kind of group consensus on curriculum (typically dressed in the guise of "academic freedom") represents something of a victory - a confluence that was previously unknown at this institution.

The standards themselves have provided a common element across disciplines and the various tasks that are part of teacher training, which has increased consistency in the way teachers are trained. However, the BTS does not stress technology directly, but implicitly. For example, the standard:

"Teachers create learning experiences that reflect an understanding of central concepts, structures, and tools of inquiry of the disciplines they teach... "

Includes the following sub-standards with implications for being able to use technology-

2.3 select instructional materials and resources based on their comprehensiveness, accuracy, and usefulness for representing particular ideas and concepts.
2.4 incorporate appropriate technological resources to explore student exploration of the disciplines.
2.5 use a variety of explanations and multiple representations of concepts including analogies, metaphors, experiments, demonstrations, and illustrations, that help students develop conceptual understanding.

Prospective teachers at URI are required to complete a portfolio at three separate stages in their program: Prior to admission, prior to commencing their student teaching, and upon completion of all program requirements. The first portfolio is basically a compilation of evidence that candidates are qualified for admission. The second is designed to provide evidence that students have acquired an appropriate understanding of pedagogy through their methods courses. The third contains evidence that they have met all eleven BTS, and are thus qualified for certification. This evidence is compiled on an ongoing basis as they proceed through the program, and culminates as their final task at the end of student teaching.

Electronic Portfolio System

Until recently, the compilation, storage, and organization of this material have been isolated efforts for each student. As part of the technology integration endeavor at URI, this process has been re-designed to allow students to do these tasks electronically. This system is designed with a database structure that allows students to store and organize their evidence for each standard on a server that allows web-based access. Students can view and update their portfolio at any time from any location.

Faculty also have access to communicate with students about their progress, to view work that has been completed, and to grade each element of their students' portfolios. The online nature of this process changes the role of individual instructors to the extent that this interaction that is so vital to new teachers' growth now takes place within a paperless format. Typically, this type of change is one that could be expected to meet resistance, since the move to grading work online is not essential in a paper-based system.

Searching capabilities built into the database also allow outside reviewers and program accreditors to view evidence of the effectiveness of the teacher training programs at the university. This fact has also increased the level of buy-in from both the tenure-track and adjunct faculty, as they are forced to address an increased level of accountability for the program. Accrediting bodies are now requiring specific alignment of tasks and syllabi with standards, as well as more standardized methods for determining whether students have met the requirements and achieved the competencies outlined in the standards. As described above, the online portfolio system has been designed to align SOE curricula with the BTS. This provides a specific and consistent way for the program to address these issues of accountability, and is a powerful lever for motivating faculty to change and to buy in to new procedures.

The process of compiling and reviewing electronic portfolios provides one avenue for enhancing the technological capabilities of both faculty and students. For both groups, the portfolios represent a critically relevant task that requires the use of technologies such as text manipulation, digital storage, digital photography, video, and sound editing. Tying these technologies to one of the core tasks in the credential programs has significantly increased motivation to learn these technologies. The portfolio development process requires each program to carefully reflect on the essential elements of its curriculum and the pieces of evidence to be considered as indicators of the standards. Attainment of any standard requires satisfactory completion of multiple core projects, each of which may provide evidence to more than one standard. Careful planning of these projects and the nature of the technology used is required to assist faculty in planning assignments in specific courses.

In its effort to bring together all departments responsible for training teachers, the SOE is in the process of expanding the training in and use of this portfolio system to all relevant faculty and students. This in turn is helping to expand technology training beyond the teacher education faculty in a way that is consistent with the goal of integration versus isolated skill development. Traditionally, those departments outside the SOE that train teachers (e.g., music, art, foreign language, etc.) maintain a certain level of independence and isolation from the SOE. Accrediting bodies are now requiring the SOE to be responsible for any students who gets their teaching credential from any program within the university. This has created a substantial increase in the desire to work with those programs more closely, in order to help ensure the quality of training their students receive. The electronic portfolio system is serving as a way to bring all departments that train teachers under the SOE umbrella. They are required to meet similar standards of accountability, and the portfolio system will help make that job easier and more consistent for all programs involved.

Preparing Tomorrow's Teachers for Technology (PT3)

While the electronic portfolio system is helping to increase faculty motivation for technology use, it does not specifically address ways that technology can be used to change the nature of their instruction and training of teachers. This is currently being accomplished through the SOE's PT3 implementation grant. This initiative supports Education and Arts & Sciences faculty members in their efforts to experiment with ways to use technology to change and/or enhance what they do at the university. This represents an opportunity to increase the use of technology in content area courses that student teachers encounter in their Arts and Sciences majors (see Bull and Cooper 1997).

Regular meetings between faculty members from multiple departments and K-12 classroom teachers facilitate discussion of innovative technologies and techniques for using them in the classroom. This forum creates an opportunity to increase faculty self-efficacy with technology through the sharing of effective uses that are already in place (Faseyitan, et al. 1996). These meetings have also helped in the formation of partnerships across disciplines that have increased participants' exposure to other methods, issues, and concerns about using technology in education.

While most of the efforts that have been described in this paper are focused on group processes and outcomes, the PT3 project provides the most support for individual endeavors to integrate technology into practice. Technical support is provided for the entire SOE through the grant in the form of knowledgeable faculty and student employees. Individual faculty members are also being encouraged to experiment with technology to change the ways in which they conduct instruction and supervision in the teacher education process. This experimentation is encouraged and supported through the availability of funds for hardware and software, and through individual mentoring and support.

Conclusion

The process of change within any university is unpredictable, given the traditional freedom that is expected by faculty members in their role as experts within their disciplines. Most attempts to mandate change in practice are met with resistance due to a perception of infringement of this freedom. The School of Education at URI has approached the task of changing practice through technology integration as a group process. By achieving consensus on curricular changes that must be made in order to satisfy more rigorous demands from accrediting bodies, the SOE has taken a significant first step in changing teacher training to align the curriculum with state standards for beginning teachers. In addition, the SOE has increased faculty acceptance of the potential that technology holds for enhancing practice by creating a process of teacher education that fully integrates technology into the key steps of that process. Faculty get meaningful, hands-on experience with technology in teacher education, because it is required to complete key components of the mission of the SOE.

This group process is simultaneously supplemented by support for individual efforts to use technology to enhance practice. Through a PT3 implementation grant, the SOE is encouraging faculty to engage in dialogue across programs and departments, and in experimentation with the ways in which they have traditionally functioned as teacher educators. Through these combined group and individual processes, URI is attempting to get faculty to examine and explore the potential that technology holds for enhancing teacher education and individual practice.

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Teaching, Learning and Technology: Providing for Higher Education Faculty Professional Development

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Abstract: Recognizing the need to better prepare teachers in the appropriate and effective instructional applications of technology has not been a difficult task for the faculty at Northern Kentucky University (NKU). The adoption of the ISTE *Recommended Foundations for Teachers* and a five-year *Technology Plan for the School of Education* in 1998 set the stage for increased emphasis on technology education at NKU. While the faculty supported these initiatives, there were many concerns about how best to accomplish these tasks. One of the critical needs identified by faculty in their ability to infuse technology into the teacher education program involved their own technological skills and abilities. Professional Development of faculty became a high priority issue. This paper describes the professional development component of NKU's Teaching, Learning and Technology (TLT) Project.

Introduction

Schools and Colleges of Education must review and revise their teacher education program as needed in an effort to prepare teachers to meet the challenges of current school and classroom environments. As society changes, the educational needs of students change. Technology, today, is a primary problem-solving tool in many aspects of society. Schools must prepare students to use technology effectively, which means that teachers must also know how to use technology effectively. Institutions of Higher Education who do not address the technological needs of P-12 teachers will be unable to provide society with the best teachers.

Robinson (2000) states that changes in the use of technology in the classroom necessitate strategic planning and forethought. He emphasizes the importance in the planning and preparation of the institution's most valuable asset --- people. Hixson and Tinzmann (1990) describe institutional change as both a people and a policy process. They continue to point out that professional development is the primary vehicle through which important educational changes are implemented as one of four overriding principles. Northern Kentucky University (NKU) recognizes the importance of the people within the institution as the developers and implementers of any institutional change.

NKU's School of Education uses a continuous review and assessment model for both student and program evaluation. Strategic planning is an on-going and reflective process. Standing committees make recommendations to the faculty for consideration in revising, refining and updating the teacher education program. Committee recommendations are often based upon standards from learned societies, accrediting agencies, student performance measures or other available data. In 1998, the Technology Committee recommended to the faculty the adoption of the ISTE *Recommended Foundations for Teachers.* Once approved, these standards became the basis of the technology-training component of NKU's teacher education program. With these standards in mind, the faculty approved a five-year *Technology Plan for the School of Education* which included four major goals to help provide better technology preparation of teachers: (1) to provide the students and faculty in the School of Education with the most advanced multimedia teaching and learning environments, (2) to assist faculty in becoming fully competent in using multimedia in their teaching, (3) to develop a plan for maintenance and regular software and hardware upgrades of the faculty and staff computers within the School of Education, and (4) to revise the manner in which the School of Education ensures and verifies that undergraduate and graduate students completing a degree or certification program at NKU have the necessary skills in using technology in the classroom.

Setting the Context

The importance of having teachers within the state of Kentucky who are more technology literate has been supported by several key initiatives. Increased emphasis on the use of technology in P-12 schools began with the implementation of the Kentucky Education Technology System (KETS) during the early 1990s. And, in May 1999, the Education Professional Standards Board in the state of Kentucky implemented a new technology standard for both new and experienced teachers. The statewide technology standard is based upon the ISTE technology standards for teachers. Kentucky teachers are expected to use technology to support instruction; access and manipulate data; enhance professional growth and productivity; communicate and collaborate with colleagues, parents, and the community; and conduct research.

Many teachers, however, do not feel prepared to use technology effectively. The Kentucky Institute for Education Research (KIER) stated in their January 1999 report that 26% of all new teachers in the state of Kentucky felt moderately/very poorly prepared to "use technology as an integral part of instruction". A principal survey conducted by Northern Kentucky University in 1999 found that 25% of area principals felt that their teachers were moderately/very poorly prepared. A 1999 business and education study (Forward Quest) in Northern Kentucky called for effective implementation of technology in our schools and the Northern Kentucky Cooperative for Education Services (NKCES, 1999) *Professional Development Needs Assessment* found that 12 of the 25 priority needs of area educators involved one or more areas of technology.

NKU's faculty addressed the need to better prepare teachers to use technology with the adoption of the *Technology Plan for the School of Education*. Technology standards were already beginning to be included within the teacher education program. However, concerns existed about how to meet these goals and fully implement the new technology standards. An outside consultant interviewed faculty during the 1999-2000 academic year and identified three main concerns in their ability to integrate technology into their classroom: (1) convenient access to the technology, (2) training on how to use technology and (3) time to experiment and redesign their classes to include more technology.

The TLT Project

During the 1999-2000 academic year, NKU was able to begin to build capacity for technology training of new teachers with the award of a one-year PT3 grant from the United States Department of Education (U S DOE). This grant allowed NKU to accomplish major beginning steps in the implementation of the five-year technology plan. The next step to be able to fully implement all components of the technology plan became possible with the award of a three-year PT3 implementation grant from the U S DOE.

The goals for NKU's Teaching, Learning and Technology (TLT) Project are based upon three of the four goals outlined in the *Technology Plan for the School of Education*. The goals for this three-year project are to continue to build upon the successful integration of technology into the teacher preparation curriculum by providing:

- **TECHNOLOGY-RICH ENVIRONMENTS**: providing technology-rich environments for students and faculty, both on-campus and in field placements.
- **FACULTY PROFESSIONAL DEVELOPMENT**: designing and implementing professional development for NKU faculty.
- **STUDENT PROFESSIONAL DEVELOPMENT**: ensuring that students seeking initial teacher certification have the necessary skills and resources to use technology in their teaching and learning.

The professional development of NKU's faculty is a crucial component to the successful implementation of this project. Classrooms can be equipped with state of the art technology. However, if faculty do not know how to use the technology in their classroom, then technology will once again be lost to the students.

Teacher education students can be required to provide evidence of their knowledge and skills with technology. However, they will be unable to demonstrate effective and appropriate uses of technology to support instruction if

they have not observed these best practices. It might be possible for teacher education students to become familiar with effective instructional practices with technology if their field placements provide these models. There is no guarantee that this will happen as evidenced by the reports noted above that in-service teachers do not feel prepared to use technology effectively. It is imperative, then, that our faculty model best practices with technology just as they do with instructional strategies, classroom management, evaluation and assessment.

Providing for Professional Development

At NKU, the teacher education program includes faculty from most disciplines across campus. NKU's faculty have a wide variety of technology concepts and skills ---- ranging from leaders in technology use and innovation to those who have yet to turn on a computer or use email. As part of the TLT Project, professional development is provided to our faculty through formal or informal venues. The School of Education's Technology Coordinator works as a "technology mentor" to faculty providing not only professional development but also continuing support for faculty who are working to infuse technology into the teacher education program.

Formal professional development

Each semester, a select group of faculty receives three semester hours of reassigned time for professional development in the area of technology. This reassigned time allows faculty to participate in structured technology training. It also provides the time for restructuring or redesigning their individual courses to include technology.

At the beginning of each semester, the Technology Coordinator meets with the group of faculty who are receiving reassigned time for technology training. During this meeting, each faculty member identifies a list of personal goals/objectives they wish to accomplish in order to infuse technology into their classes. This is similar to a professional growth plan that P-12 teachers may develop as part of their professional development. Faculty also provide "before" samples of course syllabi or other course materials that they expect will be revised/updated as a result of their technology professional development. With the goals of each faculty member in mind, the Technology Coordinator assists in the development of a plan for accomplishing these goals.

A time and location are identified for regular meetings with the faculty technology group. Based upon the skills and knowledge of the faculty for that semester, the formal meeting times may be weekly or biweekly. Each meeting will focus on one of the goals/objectives of the faculty group. Development of web pages and/or use of the Internet to enhance their classes has been the most requested formal training request. Additional requests have included technology standards, presentation software (such as PowerPoint), spreadsheets, educational software, and technology resources along with individual requests for training with basic computer skills.

Many of the structured training sessions are conducted with the entire group of faculty who has received the reassigned time. One or more faculty members may have specialized or individual needs that others in the group may not require. To accomplish these individualized needs, the Technology Coordinator may work one-on-one with the individual faculty member. In the case where the needs are outside of the Technology Coordinator's realm, the faculty member may work with someone else or do independent research that is later shared with the group. Two examples that reflect this individualized approach: (1) the science and math education faculty wanted structured training on the use of CBL's and their use with graphing calculators. This was provided by a Chemistry professor from the College of Arts and Sciences on campus who had extensive experience with this technology. (2) one faculty member was so new to technology and did not feel comfortable with turning on the computer or using email. The Technology Coordinator met once a week with this faculty member and provided very individualized instruction on basic computer use.

Informal Professional Development

Changes and issues related to technology in the instructional setting are on-going. Even the most proficient technology-using teacher has to participate in some form of professional development just to keep up with the technology revolution. And, often the time within a particular class or single training session is not adequate to explore a technology topic in depth or to expand upon the basic training provided.

Technology seminars are regularly scheduled to provide opportunities for both faculty and students within the teacher education program to learn new technologies or explore beyond the basics of specific technology skills. These seminars are conducted by NKU students, faculty or area educators. Faculty who participated in formal professional development training during the previous year have provided seminars on their current projects or use of technology in their classes. Area educators have provided updates on statewide initiatives in technology education or shared projects from their schools or districts in technology.

As noted above, these seminars are open to all NKU faculty, teacher education students and area educators. One interesting outcome of our project is the interest of the teacher education program staff in these seminars. The staff is invited to these seminars and the Technology Coordinator is working with them to develop seminars specially designed for their needs. The staff serves as an important support system for our faculty and students. A strong technology foundation for our staff will provide our faculty and students with additional resources for technology issues.

On-going Support

Providing faculty with reassigned time and formal professional development for one semester will not ensure that technology will continue to be infused into their classes. Changes in technology, standards in teacher preparation and needs of area schools will require faculty to continually review, revise and update their classes for the current demands. The role of the Technology Coordinator will be to provide regular updates and maintenance of faculty skills and knowledge long after the formal technology training period. Technology seminars will be an important means of providing new and current information to all faculty and students. NKU will also be providing a central location for faculty development of professional materials. Student technology leaders are also being trained to provide technical support to students and faculty in the development of instructional materials.

Concluding Remarks

Faculty who feel comfortable with technology are more likely to infuse technology into their courses. The professional development opportunities provided to NKU's faculty often begin with learning the technology. But, an important component of the training also includes best practices with the technology. As each semester progresses, faculty are becoming more familiar with technology and beginning to use some level of technology in their teacher education courses. Other faculty members are able to find models and ideas from their colleagues about possible uses of technology in their classes. The "after" training samples of course syllabi, web pages and other course materials are already beginning to reflect the increased infusion of technology into NKU's teacher preparation program. The true test will be the long-term evaluation of course materials and the quality of student assessment measures related to technology skills and knowledge.

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Infusing Authentic, Content-Based Technology During Teacher Preparation: A Team Approach

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Abstract: Focused teams of professors, K-12 teachers, graduate students and educational technology staff help faculty and teacher candidates infuse technology into academic activities. The faculty integrate technology into instruction, use technology in mentoring candidates in their disciplines, and collaborate with K-12 teachers in technology rich schools. A team is assigned to each certification subject area and has as a high priority the development of interdisciplinary partnerships among faculty in teacher preparation programs and the faculty of arts and sciences. Candidates collaborate with teachers in public and private schools who have been identified for skills in integrating technology into learning. The goal is to ensure that all candidates graduate with a demonstrated ability to provide innovative and authentic technological support for learning. A 3-year cross sequential design has been implemented to evaluate the influence of the project on the abilities and attitudes of teaching candidates.

Introduction

A major theme of current research and of the New Jersey Core Curriculum standards is that students learn from thinking, and thinking is engaged by activities - solving a problem, writing a melody, arguing a point (Jonassen, Peck and Wilson, 1999, p.1). Students gain disciplinary knowledge when they are engaged in problems meaningful to those disciplines, rather than in the more synthetic activity common in school (Brown, Collins, and Duguid, 1989). Students learn any content area best by *doing* it. Since the process of learning is enhanced through authentic, thoughtful activity, integration of technology within the curriculum should itself be active and authentic. Students make the best use of technology when they use it as a tool for thinking, to learn something they want to know, prompted by a problem that is significant to them. Learning is further enhanced when students collaborate to solve problems or accomplish goals, and share memories and strategies (Perkins, 1991). It is important for teachers to be able to understand and use technologies that enhance conversation and collaboration.

Rutgers, the State University of New Jersey, has redesigned its teacher preparation programs as five-year experiences culminating in a baccalaureate degree in an academic content area and a masters degree in education. This reflects the aim that candidates become qualified teachers who are subject area experts, adept at scaffolding learning within their disciplines. The current project is key to the redesign. It originates, implements and evaluates infusions of technology in each discipline. The goal is to ensure that all candidates graduate with a demonstrated ability to provide innovative and authentic technological support for learning.

With initial funding from Johnson & Johnson Corporation, the project worked with academic leaders and educators in the university and school districts to (1) evaluate current use of technology in Rutgers teacher preparation programs, and (2) design system wide changes in the way Rutgers goes about preparing teachers to use technology. During the first semester, the project piloted three specific strategies in literacy, science and mathematics. With additional support through the U.S. Department of Education grant program *Preparing Tomorrow's Teachers to use Technology*, the project is now implementing a plan across all teacher preparation programs.

Weaknesses Identified in the Current Program

A survey of university professors and school district personnel administered at the onset of the project showed weaknesses in the existing program that limit the exposure of teaching candidates to modern technology, and limit their practice of technology-supported learning in academic work and school placements. Professors made modest use of technology in their class presentations and interactions with students. Only a few modeled constructive uses of technology in learning or research. Some assigned students to investigate drills or tutorials available in the school's software collections, reflecting efforts to understand how technology can be used as a teacher substitute, rather than as a tool for investigation and collaboration. Many professors admitted a lack of conceptual and practical knowledge of relatively standard technologies, such as the web, discussion groups, chat, and listservs. They had not used computers extensively in their own academic preparation, and had not yet begun to use them productively in their research and teaching. Some faculty reported they did not have clearly articulated ideas on how they could use technology and wanted guidance from more experienced faculty and staff. Others had some ideas but required additional support to implement them. They asked for educationally grounded technologists who could help them frame issues and design approaches, not pure technicians.

An examination of the existing courses of study revealed a structural weakness. Teaching candidates were intended to gain technology expertise through a technology requirement in their programs, but most students fulfilled it by taking a basic programming class with little regard to pedagogical issues, and no connection to the subject area classes. There was no coordination of assignments between the classes that would, for example, encourage elementary science students to develop web sites with links to important, reliable resources for areas of science poorly represented in their texts. As a result, many candidates in the existing program got little or no systematic exposure to educational technology.

These shortcomings in preparation were reflected in the candidate's skills at infusing technology into learning. Superintendents in school districts agreed that most of the new teachers they hired from Rutgers or other institutions needed significant training before they could use technology meaningfully in their work. Though the new teachers had basic technical skills, they were not equipped to provide leadership in how to incorporate modern technology into the classroom. The districts and professors agreed that there was little collaboration and coordination among cooperating teachers in districts and professors in the university regarding technology. The use of technology by candidates in different academic areas was not compared or coordinated to ensure that it was meaningful, or to exchange ideas about how technology might be used. These and other weaknesses identified through the survey drove the development of the project design.

Project Design

The central feature of the project is the development of focused subject-area teams of professors, K-12 teachers, graduate students and educational technology staff. The teams help faculty and candidates infuse technology into academic activities. They have as a high priority the continuing development of interdisciplinary partnerships between the teacher preparation programs and the arts and sciences faculty. Each team is led by a professor who is committed to the goals of the project.

A team is assigned to each certification subject area and has two responsibilities: (1) to continually evaluate the experiences candidates have with technology throughout their time in the program to ensure that they develop effective skills; and (2) to design meaningful infusions of technology into learning appropriate for that subject area. The teams assist faculty to more fully integrate technology into learning and help them guide candidates as they complete mentored projects. In the process, candidates collaborate with teachers in public and private schools who have been identified for their skill at integrating technology into learning. The teams support the school teachers as they infuse technology into the experience of candidates during their teaching placements. Elementary and high school students participate in these activities. The technology-rich districts that participate in the program have close ties to the university and have well equipped classrooms with good opportunities for hands-on training of candidates. As the teams work with professors who teach the subject area courses and support the cooperating teachers in the districts, they provide curriculum and faculty development on an ongoing basis. The project is continuously assessed to inform future work. The primary objectives are to:

1. Engage teacher candidates in activities during subject area classes and teacher placements that develop the skills they need to use technology effectively in their future classrooms.
2. Provide technical support, instructional support, incentives, and faculty development for subject area professors to help them effectively practice and model technology integration.
3. Develop collaborations among Rutgers professors, teaching candidates, and teachers in technology-rich school districts.
4. Encourage faculty within and between disciplines to collaborate on meaningful instructional uses of technology and to share problems, strategies and solutions.
5. Use assessment information developed throughout the experience to continuously correct flaws, redesign, and replicate successful activities.

A Project Team Example: Encouraging Apprenticeship and Mentored Research

Students learn content areas best when they are engaged in meaningful problems within the discipline, when they are *doing* the discipline in apprenticeship with a mentor (Palincsar and Brown, 1984). When teacher preparation students are in a mentoring relationship with an experienced researcher they can begin to understand contemporary approaches and thought in their field. Science professors in the Graduate School of Education have partnered with professors in the science departments to support teacher preparation students in substantive work in contemporary science. In the summer before science candidates enter their fifth year, they attend either the Rutgers Waksman Student Scholars Summer Institute or the Rutgers Astrophysics Institute for an intensive study in their chosen field. They work with current teachers and high school students, and with Rutgers faculty from the Graduate School of Education and the departments of Genetics, Physics, and Chemistry. In the process of doing real science, candidates learn about emerging technologies, experimental design, research methodology, laboratory procedures, data collection and analysis, and scientific reporting. The science support team guides the candidates using constructivist instructional methodologies that can be incorporated in classroom practice.

As part of the Astrophysics Institute, for example, students use the internet to examine NASA's X-ray photon counts collected by satellites orbiting the earth and perform quantitative analysis of the data using software tools. They construct models of objects that emit photons in an attempt to identify them as white dwarfs, neutron stars, binary stars or other phenomena. During the summer they learn the physics and data analysis techniques needed to conduct research. During the following year they are challenged to solve problems posted on the web and to report their findings there. One important aspect of this program is that the candidates get raw data as quickly as any researchers in the world and do real investigative science. As they use live data, they become part of the internet-based scientific community.

The development of a collaborative relationship between the GSE and the three major science departments in the education of science teachers has been critical to the program's success. All four units have come together to implement an integrated approach to the education of science teachers. A similar model is followed for other disciplines, including literature, history, world languages, and social sciences. The History team, for example, is making good use of the Valley of the Shadow web site developed at the University of Virginia (Ayers, 1999). The site provides rich primary sources from two communities during the civil war, including letters, diaries, newspaper articles, soldier dossiers, and battle plans. The candidates learn history by doing it. They perform historical research from primary sources and practice techniques to scaffold their own student's learning of history.

Criteria for Evaluating Instructional Activities that Infuse Technology

Instructional activities are being assessed according to the criteria shown in Table 1 (adapted from Jonassen, Peck and Wilson, 1999, page 227-231) to evaluate how meaningfully they are embedded in each discipline and teaching placement. The criteria are being further refined for specific content areas.

Table 1. Criteria for Instructional Activities Infusing Technology

1. To what extent is the activity naturally complex and embedded in a real world context?
2. To what extent do candidates observe and reflect upon their actions?

3. To what extent is technology contributing to the attainment of specific goals?
4. Do candidates engage in this because it is required or because it is of intrinsic interest?
5. Do candidates wrestle with new experiences and become expert at identifying problems?
6. To what extent do candidates spend time engaged with other learners?
7. To what extent do candidates improve in their ability to negotiate with other learners?
8. Do candidates simply memorize or do they generate hypotheses, evaluate, assess, predict?
9. To what extent is there one 'right' answer, or does the activity foster generation of multiple complex solutions of varying quality that can be analyzed and evaluated?

The Study

A 3-year cross-sequential (longitudinal and cross-sectional) design has been implemented to evaluate the influence of the project on the abilities and attitudes of the teaching candidates in the program. Data was collected in the first semester of the project from teaching candidates in the junior, senior, and fifth year in the teacher preparation program, and from all post-baccalaureate students in the program. The initial data was collected through a paper and pencil instrument. Performance-based evaluations of abilities will be made later in the year. The paper and pencil instrument was used to collect two types of information: student attitudes about the importance of specific internet and productivity technologies, and student abilities to infuse technology into learning. Students self-rated their competence with various technologies and their ability to develop meaningful learning activities that involve technologies. They also proposed specific ways that technology can be meaningfully used to support learning. Data will be collected each semester over the next three years as students are tracked through their programs.

A total of 458 students were assessed this year, approximately 96% of those in the program. A preliminary analysis has been conducted. While most students rated themselves as competent using email and searching the internet, they assigned themselves lower ratings at using other internet applications such as listservs, chat rooms, and online discussion groups - most rated themselves as not familiar at all with web-based distance education or with interactive TV. Similarly, students rated themselves as competent using word processing software, but assigned themselves lower ratings at using other productivity software, such as presentation packages, databases and spreadsheets. The majority rated themselves as not familiar at all with modeling and simulation software or with data analysis tools. Almost half indicated they had never attempted to develop meaningful learning activities involving technology or could do so only with assistance. This held across program and year. More than half indicated they had a similar weakness in applying current instructional principles, research and assessment practices to the use of computers and technologies. Finally, across program and year, most students were unable to propose specific ways that technology can be meaningfully used to support learning. There were some differences by year: post-baccalaureate students rated themselves as less competent with certain technologies, such as listservs, chat, and online discussion groups than did the students in the five-year program. All groups, however, gave similar high ratings to the level of importance that teachers should hold for internet technologies.

Conclusions

Current and emerging technologies include powerful tools that can be used to spur thoughtful, authentic activities within content areas. Yet professors tend not to model constructive uses of technology in learning or research, and school districts find that the new teachers coming out of teacher preparation programs are not equipped to provide leadership in how to incorporate modern technology into the classroom. Initial assessments from the project study reveal striking weaknesses in the ability of teacher preparation students to apply instructional principles, research and assessment practices to the use of technologies in their disciplines. Students are unable to propose specific and meaningful ways to infuse technology into learning activities, though they recognize their weaknesses and assign a high level of importance to technologies in teaching and learning.

The main goal of the current project is to help students learn to develop meaningful infusions of technology in support of learning. A key element has been the development of focused subject-area teams of professors, K-12 teachers, graduate students and educational technology staff to help faculty and candidates

infuse technology into academic activities. It is anticipated that student attitudes and abilities will develop over the life of the project. By engaging students in meaningful technology-enhanced activities during subject area classes and teacher placements, and by providing significant technical and instructional support for faculty who practice and model technology integration, it is hoped that teaching candidates will graduate with a demonstrated ability to provide innovative and authentic technological support for learning.

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Magnetic Connections: Better Preparing Preservice Teachers to Use Technology in Teaching and Learning

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Abstract: Technology provides opportunities to link students, faculty, partners in education, and the wider communities together to expand, improve, develop, and enhance the learning experience for all. It is this challenge that has led California Lutheran University's (CLU) School of Education to conceive and implement Project MAGNETIC CONNECTIONS. Progress on the project can be measured through five major activities. These activities include development of a teacher/scholar in residence program, use of an electronic portfolio system and other distance learning technologies, faculty development workshops, and revision of the Teacher Preparation Program curriculum. Results indicate that CLU is better preparing preservice teachers to use technology in teaching and learning and they are provided with better models and mentors for integrating technology into the curriculum. As well, preservice teachers are held accountable for meeting state and CLU standards for beginning teachers through the use of a web-based electronic portfolio system and distance learning technologies.

Introduction

The nation's teaching force faces a critical challenge as a record number of students enter our schools. By 2008, schools will need to hire more than 2.2 million teachers to serve growing student enrollments and to replace the considerable number of current teachers expected to retire in the coming years. In California, shortages are particularly acute. Educating nearly 11% of the nation's student population, California's school enrollment is at about five million and growing by more than 100,000

students per year. California will need to hire more than a quarter of a million teachers over the next decade. (Haselkorn & Harris, 1998).

This extraordinary need for teachers comes at a time in which the demands placed on teachers, particularly in California, has never been greater. Already serving the nation's most diverse population, California provides a look ahead to many of the educational and demographic challenges facing the nation in the 21st century. Like many other states, California has embraced the "standards movement" calling for more accountability for teachers, students, and schools. Therefore, at the very time we are asked to produce more teachers through a greater variety of teacher preparation routes, we are also being called upon to prepare a more capable workforce that is well prepared for the challenges and complexities of the next century.

Technology offers promise as a tool and a resource for those of us who prepare teachers, and for teachers themselves who are challenged to provide more and better services and educational opportunities for students. It challenges us to think about new ways to link our students, our faculty, our educational partners, and our wider communities together to expand, improve, develop, and enhance the learning experience for all. It is this challenge that has led the faculty in the School of Education at California Lutheran University to conceive the plan for Project MAGNETIC CONNECTIONS.

California Lutheran University and its school partners have already committed significant resources to developing and supporting our technology capabilities. Yet, technology itself is not pursued as an end in itself but as a vehicle and medium for teaching and learning. The Information Systems and Services unit of our university has articulated a vision statement that reads: "We build community by providing solution oriented, integrated information resources and services. Our graduates are technologically competent and competitive in a global market."

The School of Education has embraced this vision in our own strategic plan, which calls for us to infuse technology throughout all of our programs. Nowhere is this challenge more important than in teacher education.

Teacher education does not occur in isolated classrooms that are disconnected from practice. We believe that making, building, and strengthening connections are vital to the future of teacher education. CONNECTIONS between content and pedagogy, CONNECTIONS between theory and practice, CONNECTIONS across the curriculum, CONNECTIONS between the university and the schools, and CONNECTIONS between teachers and students are only some of the most crucial linkages that must be made. Technology holds promise of being a tool and a resource for making these CONNECTIONS.

There is a natural affinity and powerful draw among the participants in this project; they have common goals and purposes to improve teaching and learning for all. They have already committed to the use of technology as a vehicle for improved instruction. These common purposes serve as a MAGNET, drawing together all of the players and the resources they bring to the table. In this project, a primary resource for linking with the real world of practice is three MAGNET schools—schools with a special focus on technology. Therefore, we have entitled this Project MAGNETIC CONNECTIONS, in anticipation that we will build on this natural affinity to strengthen these powerful connections through the use of technology.

Many have predicted that technology has the potential to change education in dramatic ways. (Hertzke & Olson, 1994; Kent & McNergney, 1998). However, teachers often report that they are not well prepared to use even the limited technology available in school classrooms. Even though they may know ***how*** to use the computer-based technology they find in their classrooms, they may not know how to use it for effective instructional purposes. This is not surprising, considering the history of teacher preparation program practices. Arthur Wise, President of NCATE (1998) suggests that the models provided for preservice teachers are inadequate for today's technological demands on the teaching profession.

> Despite the technology changes in society, being a teacher in American schools too often consists of helping children and youth acquire information from textbooks and acting as an additional source of expertise. Teachers are provided role models of this approach to teaching from kindergarten through graduate school; their teacher education courses provide hints for making textbook-oriented instruction interesting and productive, and as teaching interns, they both observe and practice instruction based upon mastering information found in books. Teachers may be forgiven if they cling to old models of teaching that have served them well in the past. All of their formal instruction and role models were driven by traditional teaching practices. (p.5)

If teachers in elementary and secondary schools are to use technology well, they must experience its use in their own learning. Sandholtz, Ringstaff & Dwyer (1997) indicate that students learn best about the appropriate use of technology in the classroom when they are provided with models of good practice.

As we take the necessary steps to achieve our vision for teacher preparation in the twenty-first century, our faculty identified five areas related to our human and technological resources that need to be addressed. These areas are:

- providing better teacher training in the selection, access and use of technology in teaching and learning;
- providing better mentors and models for preservice teachers in the form of university faculty, K-12 master teachers, and university supervisors, who integrate and appropriately use technology in their own teaching and learning;
- expanding the Teacher Preparation Program to reach more preservice teachers;
- developing and using new assessment models that incorporate the use of an electronic portfolio system; and
- building better linkages between subject matter and professional preparation and K-12 schools.

The Project MAGENETIC CONNECTIONS

Although prior to beginning this project, many School of Education faculty members already used technology to deliver and enhance instructional opportunities, conduct research, and communicate with students outside of class, our own studies indicated that this use was highly idiosyncratic, largely dependent upon the interests and inclinations of the individual faculty member, course specific, and not well connected to any overall programmatic vision or initiatives. We were poised to take the next step to fully integrate technology into our program and to utilize its power to significantly change the way we prepare teachers for their work in contemporary schools when presented with the opportunity to apply for external funding to help accomplish our goals.

Project MAGNETIC CONNECTIONS is strengthening the links between teacher preparation programs and k-12 schools through live, real-time connections and shared learning opportunities between the partners. The three technology-rich schools have become "laboratories for learning" for CLU students and faculty and are connected via distance learning capabilities to CLU students on the Thousand Oaks campus and to its graduate centers in Woodland Hills and Ventura. All CLU students are developing a web-based electronic portfolio, documenting their progress and accomplishments as they advance through the "benchmarks" of the teacher preparation program. They are taught and mentored in their use of technology by highly trained teacher education faculty and two visiting teacher/scholars (clinical faculty) in residence for the duration of the three-year program.

The project includes conferences and workshops to redesign the teacher preparation curriculum at California Lutheran University to infuse technology into the teaching and learning process. We are developing and implementing an electronic portfolio system that is linked to the six domains of the California Standards for the Teaching Profession. Preservice teachers and education faculty are utilizing the new electronic portfolio system to enhance communication regarding professional expectations and preservice teacher accountability for meeting those standards.

In July 1997 The California Commission of Teacher Credentialing and the California Department of Education adopted the California Standards for the Teaching Profession (CSTP). The standards were jointly developed by the two agencies to facilitate induction of beginning teachers into professional roles and responsibilities. The standards provide teachers and teacher educators a common language and structure to describe the complexity of teaching and are intended to guide teachers as they develop their professional practice.

The standards are organized around six interrelated categories of teaching practice. In summary, they are, 1) Engaging and supporting all students in learning, 2) Creating and maintaining effective environments for student learning, 3) Understanding and organizing subject matter for student learning, 4) Planning instruction and designing learning experiences for all students, 5) Assessing student learning, and 6) Developing as a professional educator. The list is not intended to be sequential, and does not indicate priority or value, but is merely numbered to facilitate identification and discussion. The 6th standard does

not describe specific classroom conduct but is more a reminder of the need for ongoing professional development and relationships.

The six categories provide a developmental, holistic view of teaching intended to serve the needs of the diverse student and teacher populations in this State. The overlap that is evident among the standards communicates the interrelationships and complexities of teaching that require continued development of professional judgement. The standards are designed to support work in diverse classrooms in a variety of ways, and not to force a single approach on all practitioners. Use of the standards is intended to stimulate reflection on practice, formulation of goals, and assessment of growth. Therefore the use of these criteria is flexible.

The Department of Teacher Education in the School of Education at California Lutheran University adopted the CSTP's as an organizing principle for its teacher credential programs. Curriculum and assessment approaches are now based on the standards, with an emphasis of providing evidence of progress on the first five. Preservice teachers are held accountable for these standards through the use of a web-based electronic portfolio system. This web-based system allows students, faculty, educational partners, and education employers to expand, improve, develop, and enhance the learning experience for preservice teachers. However, reliable identification and description of student work for purposes of formative growth remains the primary purpose for the use of the state standards and the electronic portfolio system at CLU.

Implementation of a web-based electronic portfolio system throughout the teacher preparation program complements the student-centered approach CLU takes to preparing teachers for the classrooms of tomorrow. The portfolio system is analogous to a relational database that is cooperatively developed by faculty, students, cooperating teachers, supervisors and employers. It enables a grand conversation between these parties, focusing around the student's professional development. The state standards (CSTP's and technology) and the School of Education's conceptual framework of reflective, principled practice serve as a scaffold around which teacher educators and preservice teachers weave their dialog.

This dialog is enhanced through the use of other distance learning technologies, namely Tapped In (a Multi-object Orientation [MOO] for educators) and ClearPhone (an Internet video-phone). These two technologies are used mainly in real-time as teacher educators meet in virtual classrooms with preservice teachers, or preservice teachers tutor k-12 students through video conferencing. The electronic portfolio system tends to be used asynchronously as students respond to teacher educators' assignments and deposit artifacts supporting their growth and accomplishments as a beginning teacher. Only recently have the two technologies merged, where teacher educators are able to converse in real-time with students about artifacts in their electronic portfolio, either in the MOO or through video conferencing. There is much potential for mentoring preservice teachers online while holding them accountable for the standards through demonstrations and artifacts deposited in their electronic portfolio.

In order to meet the new performance standards and to integrate these technologies throughout the program, the teacher preparation program curriculum needed to be revised. This revision is ongoing and over a three-year period, the goal is to modify course goals, objectives, and assignments to reflect the vision of our teacher preparation program and ensure that all beginning teachers have met rigorous state standards for teaching and technology. Faculty curriculum revision efforts identified four major considerations that will shape the revised program. These include the School of Education's conceptual framework, the state standards for the teaching profession (CSTP's), the state technology standards and the cross-cultural and language development (CLAD) foci. Any curriculum revision must include, address and hold students accountable for meeting these state standards as well as realizing the School of Education's vision that strives to prepare principled, reflective educators. Hence, faculty and administration expect that the final revision will articulate the relationship between course goals and objectives, the School of Education's conceptual framework and the other program and state standards for teaching and technology.

Evaluation Design:

The MAGNETIC CONNECTIONS Project uses a *participatory evaluation* design. This evaluation model, described by Cousins and Whitmore (1998) and Rossi, Freeman and Lipsay (1999) views program participant stakeholders as partners in the evaluation process. The stakeholders define the evaluation purpose, create research questions, design instruments, collect data and interpret and report findings. Cousins and Whitmore (1998) and Greene (1988) suggest that such participation keeps the evaluation relevant and increases utilization of findings without sacrificing technical quality or credibility.

As a result, the evaluation seeks to change the organization or solve a problem, rather than simply collect programmatic information.

At CLU, the participatory evaluation used a formative/summative design recommend by Stevens, Lawrenz, Sharp and Frechling (1997), examining five formative and one summative goal. Participants included a sample of 17 full and part time higher education faculty, all preservice teachers and K-12 teachers at three technology rich partner schools. Instruments included document analysis of course syllabi, portfolio contents and training materials; pre-post technology use surveys of faculty and preservice teachers; observation of faculty and preservice teachers, focus groups conducted with faculty and preservice teachers and analysis on on-line transcripts. Each goal was examined with at least two data collection techniques, allowing for triangulation of findings.

Initial Results:

Preservice teachers, k-12 partners, and education faculty are conducting action research on the implementation strategies and distance learning ideas embedded in the project. The action research findings identify and amplify successful strategies for curriculum development, implementation and assessment.

Progress on the project has been achieved within five major activities:

- Teacher/scholars hired in January 2000. These teacher/scholars support the implementation of the project objectives and support preservice teacher education within the School of Education and k-12 partner schools.
- Electronic portfolio system implemented throughout the teacher preparation program. The system is based on the State standards for professional teacher development and provides a self-assessment tool for students as well as an opportunity for k-12 teachers and higher education faculty to mentor and advise preservice teachers throughout their teacher preparation program.
- Higher education and k-12 faculty workshops. Various sessions conducted in 1999-2000. Two 3-day and numerous 2-hour workshops. Topics include curriculum revision, web page construction; use of chat room software "Tapped In;" using Internet search resources; electronic portfolios; technology to connect schools; program evaluation and technology tools.
- Initiated use of distance learning technologies, including the use of "Tapped In" for teacher preparation methods block seminar discussions and "ClearPhone" videoconferencing through the Internet.
- Curriculum revision of Teacher Preparation program. Established curriculum revision teams consisting of School of Education faculty, k-12 teachers, undergraduate faculty and administrative support personnel.

All indicators suggest that California Lutheran University is:

- better preparing preservice teachers to use technology in teaching and learning.
- providing preservice teachers with better models and mentors for integrating technology into teaching and learning.
- maintaining State and School of Education standards for preservice teachers through the use of a web-based electronic portfolio system and distance learning technologies.

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Preservice and Inservice Teachers Collaborate To Integrate Technology into K-8 Classrooms

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Abstract: Preservice teachers graduating from education programs feel unprepared to integrate technology into their classrooms due to lack of modeling by university faculty and limited opportunities for observation of exemplary technology practices in internship classrooms. The Arizona State University West faculty, through a PT^3 Grant, is addressing this issue by providing workshops on integration of technology in instructional planning for cohort teams of ASUW preservice teachers and inservice mentor teachers. During the workshops, teams collaborated on developing Units of Practice integrating technology, which were jointly implemented in field placement classrooms. Workshops provided teams a variety of technology and technology resources that could be incorporated into unit and lesson planning including the Internet, digital cameras, Inspiration software and PowerPoint applications. Results indicated participants benefited greatly from the information and practical applications of the workshops. Teams demonstrated considerable skill growth for using various applications and substantial success in developing Internet skills.

Introduction

Many colleges and universities are attempting to improve teaching and learning with technology throughout their colleges of education. Nationwide, most recent teacher education graduates do not feel prepared to integrate technology in their curriculum (U.S. OTA, 1995). Arizona State University West students report that, despite taking a course about using technology in the classroom, they do not feel prepared to teach effectively with technology (Wetzel, Buss, Zambo & Arbaugh, 1996; Chisholm, Carey, & Hernandez, 1998). This lack of preparation is due to two major factors that we are addressing in a Preparing Tomorrow's Teachers to Use Technology Implementation Project. First, our students do not see consistent or extensive modeling of the use of technology by our faculty in their preservice classes (Chisholm, Carey & Hernandez, 1998). Second, we lack school sites for field placements where preservice teachers can observe exemplary technology practices in K-8 classrooms (Carlile, 1998).

In this paper, we evaluated our Practicum Plus Program that directly influences field placements for our preservice teachers in required practicum experiences. In the Practicum Plus program, preservice teachers and their K-8 mentor teachers received training together in technology integration just prior to and during the practicum experience. This is a critical intervention because practicum students are often most influenced by what they observe their mentor teachers do, or by their own school memories (Darling-Hammond & Ball, 1998). Further, cohorts of beginning teachers receive a richer, more coherent learning experience when they are organized in teams to study and practice with veteran teachers and with one another (Darling-Hammond, 1995). The PT^3 Practicum Plus Program provides technology integration workshops for preservice teachers and their mentors. During the workshops the preservice-teacher-mentor-teacher pair developed a curricular Unit of Practice (UOP), which they implemented in the K-8 practicum classroom.

Overview of the Program

The Practicum Plus Program offered collaborative, hands-on training in technology to K-8 preservice teachers and their mentor teachers to prepare them to integrate appropriate technology with grade level curriculum, incorporate state and national standards into their lessons, and practice new technologies and instructional strategies. The preservice teacher-mentor teacher teams attended workshops together prior to and during the semester. These workshops were offered at each of six partner school districts and at the Child Development Center at Arizona State University West. Each workshop was geared to a specific program area: Elementary Education, ESL Education, Bilingual Education, and Early Childhood Education. Preservice teachers were recruited during class at the end of their junior year. Summer workshops lasted 6.5 hours per day over a 6 day period; the three Fall workshops were 2 hours each.

Mentor teachers were recruited through their districts and invited to apply for the Practicum Plus program. Both the preservice teachers and the mentor teachers received three graduate credits at no cost for attending the summer and fall workshops. A total of eighty-two mentor teacher and sixty-eight preservice teachers participated in the seven cohort groups. Additionally, fifteen ASU West faculty assigned to the site-based district locations attended the Practicum Plus training with participants. ASU West faculty played a key role in defining the particular curriculum for each major program.

The workshops provided each preservice teacher-mentor teacher team the opportunity to assess the available technology at their school and district, explore and evaluate various hardware and software, locate relevant Internet sites and bookmark them, evaluate websites, use a listserv to share ideas, strategies, resources, and develop two Units of Practice (UOP) that address state and national standards. In addition, teachers presented technology-integrated activities that they have used successfully in their own classrooms. Invited speakers also introduced district standards, local technology resources for teachers and examples of their own UOPs. One of the intangible benefits of these workshops was the opportunity for preservice teachers and mentor teachers to get acquainted before the beginning of the school year and to work collaboratively as a team in developing technology-integrated UOPs that they would jointly implement in the K-8 classroom.

On the first day of the workshops, the participants were introduced to the UOP and its seven components: Standards, Invitation, Tasks, Situations, Interactions, Tools, and Assessment. On subsequent days, participants deepened their understanding of one or more components per day identifying the standards they would incorporate in their unit, developing the Invitation, and collecting on-line resources for their UOP. As pairs worked together, mentor teachers and preservice teachers became equal partners in the endeavor and learned from each other. Additionally each preservice teacher-mentor teacher cohort was introduced to the listserv that serves as a vehicle for collegial sharing.

The Study

The investigators sought answers to the following research questions. Question 1--How effective was the Practicum Plus program in preparing mentor teachers and their university practicum students to create a curriculum unit of practice in their K-8 classrooms? Question 2--How did the mentor teachers and practicum students use the cohort listserv to support the community of learners?

Method

Multiple measures were used to examine the research questions. In each of the following sections, the instruments employed and the procedures used to gather data are presented briefly.

Faculty Reflections

Faculty attended the Practicum Plus Program summer classes from each program area along with mentor teachers and preservice teachers. Twelve faculty members attended the 3 credit hour classes while four attended the 1 credit hour classes. At the end of the intensive classes faculty were asked to reflect and provide the program staff with written comments. Eight faculty members completed a reflection providing program staff with written comments. Faculty members were also invited to discuss the written reports and provide additional feedback to the program staff at a later meeting.

Daily Participant Exit Tickets

At the end of each workshop day, participants completed an Exit Ticket consisting of five prompts: One thing you learned or relearned today; one positive comment about today's activities; one idea you learned or saw today that you can use with your students; suggestions for improvement; and general comments and questions about today's topic. Content analysis procedures were applied to responses and themes were extracted.

Technology Checklist

Preservice teachers' and mentor teachers' technology skills were evaluated using a Technology Skills Inventory that assessed skills in eight areas. The eight skill areas were: General computer, equipment, Internet, HyperStudio, Inspiration, PowerPoint, Claris Works/Apple Works Slide Show; and Netscape Composer. Example skills from the Internet list included: Subscribe to a listserv; send and reply to a listserv; send an e-mail attachment; create, organize and save bookmarks; and use a search engine to conduct research. Participants had to actually demonstrate proficiency on skills in these areas.

Unit of Practice

A rubric was used to identify proficiency levels for each category of the UOP, Standards, Invitation, Tasks, Situations, Interactions, Tools, and Assessment. Each was evaluated on a scale of Accomplished, Developing, or Emerging (http://www/asu/pt[3]).

Listserv

The seven cohorts in the Practicum Plus workshops enrolled in listservs. The purpose of the listservs was threefold: To provide the participants with skills of electronic communication; to encourage collegial sharing, and to create a community of learners who could interact beyond the time and place of the actual workshops.

With respect to analyzing the data, a number of procedures were used. Generally, qualitative techniques such as content analysis was employed. Emerging themes were noted and formed the basis of subsequent analysis and interpretation.

Results

Generally, results showed the overall effectiveness of the professional development activities, which took place during the PT3 workshops. Increased levels of skills for the use of applications and the Internet were demonstrated. Specific details about the results are provided below.

Faculty Reflections

Faculty members' reflections suggest that the activities presented in the program helped mentor and preservice teachers learn how technology could be incorporated into their curriculum. Suggestions from faculty included informing mentor and preservice teachers earlier of training dates for planning purposes and to facilitate more preservice teacher-mentor matches; introduce technology and hands-on computer activities on the first day; limiting lectures; and that a model of an UOP be given to participants at the beginning of the program. The faculty also observed that the UOP template did not ask teachers to make accommodations for students with special needs. The faculty recommended that for ESL and bilingual mentors and teachers a presentation on the Teaching English to Speakers of Other Languages (TESOL) standards be made and that these standards be incorporated into the UOP. The faculty also noted how helpful it was to have direct links to state academic standards since teachers are not always familiar with the state documents that actually drive district decisions about curriculum and assessment. The faculty also commented on the teamwork that developed between the mentors and preservice teachers. The classes provided the mentors and preservice teachers with an opportunity to work together before the school year started. The mentor teachers provided the expertise in pedagogy and content while in some cases the preservice teachers provided most of the expertise in technology. The faculty also remarked positively on the incorporation of technology into their classes such as the use of a digital camera and PowerPoint presentations.

Daily Participant Exit Tickets

Several themes emerged from the Exit Ticket responses. First, participants appreciated the exposure to a variety of technology and technology resources including Internet use, digital cameras, Inspiration, and PowerPoint. Additionally, they valued the time that was allowed to work with the technology while practicing and improving their skills including developing PowerPoint presentations, Inspiration and other applications for their classrooms. Participants especially appreciated ideas that worked with small groups in situations where limited numbers of computers were available. Finally, they particularly valued opportunities related to using Internet resources including website evaluation procedures, and connections to educationally relevant websites.

Technology Checklist

Evaluation of the preservice teacher-mentor teacher Technology Skills Inventory indicates most participants demonstrated 90% proficiency on the majority of skills listed.

Unit of Practice

Results from analysis of the Unit of Practice clearly show participants strengths in the Invitations, Tasks, Interactions, and Situations components. The weak areas were in the Abstract, Standards, and Assessments components. For example, participants failed to include appropriate academic standards. Additionally, ESL education teams failed to include TESOL standards.

Listserv

Participants surpassed expectations in use of the listserv. Examples of activities are sharing teaching ideas and resources, staying abreast of current events that impact their classrooms, sharing information about websites, information about how to accomplish assignments, and support for each other on how to complete their work at the university.

Discussion

It is apparent from the results that while there needs to be more emphasis placed on the importance of infusing standards throughout the UOP, participants benefited greatly from their experiences in the workshops. Results indicate teams had considerable skill growth and success in developing Internet skills. Participants routinely subscribed to listservs, sent e-mail attachments, created and saved bookmarks, and used search engines in research on the Internet. Additionally, participants developed skills in the use of Inspiration, PowerPoint, and Netscape Composer. For example, they used Netscape Composer to create and save a new page, add a hyperlink, and add a graphic from the Internet to create a curriculum homepage for their students.

Three important components of the Workshops facilitated skill development and subsequent application to the classroom setting by the preservice-mentor teacher teams. First, transfer of learning from the professional development setting to the classroom by participants was facilitated by providing learning opportunities that reflected those that would be used in subsequent classroom settings. Such "situated" learning opportunities allowed participants to engage in activities that they could use directly with their own classroom students, later. Second, the Workshops provided participants with significant amounts of time to learn how to use technology through practice with a variety of applications. Third, and importantly, participants were given ample time to *adapt* technology skills, materials, and techniques for classroom instruction. Specifically, participants were provided with large amounts of time and support to adapt technology for their own classroom use through the UOPs, which each team developed. Frequently, professional development focuses on the former, skill instruction and development without providing sufficient support for *adaptation*, which is essential to ensure subsequent application to the classroom. Fourth, participants then implemented the units in their K-8 classrooms.

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Hypergroups as a Community-Building Tool

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Abstract: For anyone restructuring their undergraduate technology course for pre-service teachers, an important consideration should be the inclusion of a communication tool that promotes positive peer interactions. Using their recent award of a PT^3 grant the University of Houston has implemented many changes in the teacher education core technology course including the offering of a hypergroup, a web-based communication tool. By the second month participation in the hypergroup was going strong with future teachers sharing ideas, posting resources, and communicating common concerns. The hypergroup, originally intended as an example of a mode for teacher communication, has turned into a true community-building tool. The hypergroup will stay intact for these pre-service teachers throughout their teacher education program and into their first year of teaching where it is hoped that these teachers will become a part of other online peer resource groups.

Introduction

The inability to communicate with peers concerning one's subject area, classroom management, and other educational issues, is often cited as a negative in the teaching field. Pre-service teachers in the Pedagogy for Urban Multicultural Action (PUMA) program at the University of Houston are changing this negative into a positive. With the recent award of a Preparing Tomorrow's Teachers to use Technology (PT^3) grant, the Instructional Technology program in the University's College of Education has restructured its required undergraduate three-hour technology course into three one-hour courses. One of the major changes in the restructuring of the technology class was to implement a mode of communication for all enrolled pre-service teachers.

Important to note is the fact that the University of Houston is a medium-sized, urban, multicultural university whose students are largely commuters. There are many nontraditional students from the Houston metropolitan area who attend the University on a part-time basis while working full-time jobs as they pursue their degrees. Many students are on campus only to attend classes. As a result, it is difficult to develop a strong sense of student community throughout the University. The PT^3 grant implementers recognized this problem as one similar to professional teachers in general.

Application

The College of Education has long used a web-based newsgroup application in its graduate distance learning and face-to-face classes appropriately named Hypergroups, developed by a former doctoral student. Found in the NETS Professional Performance Profile is a category that focuses on peer communication;

Teachers "participate in online professional collaborations with peers and experts" (Number 18). To assist pre-service teachers in satisfying this technology requirement for their educational portfolio, one hypergroup was set up for all six sections of the first semester technology course.

Because this was a new mode of communication for many of the students, it was decided that students would learn to use the tool effectively if they were required to participate by posting to the hypergroup a minimum of 5 times within the semester. No restrictions on types of postings were given, however the idea of professionalism and the goal of the hypergroup as a resource for communication and sharing of ideas was reinforced by the technology fellows in the six sections of the course. The students were initially reticent about participating. The technology fellows initialized the group by posting welcome messages and demonstrating its use in class. Within a month, students had taken ownership of their hypergroup, posing questions, asking about assignments, posting ideas for topics and projects that will satisfy course requirements, and requesting help in other classes. For the most part, the comments shared on the hypergroup have been relevant and positive. The pre-service teachers are getting to know each other across sections through the hypergroup and are actively supporting one another.

The long-term effects of the hypergroup will begin to be apparent during the Spring 2001 semester when students are enrolled in the second semester of the technology three-course sequence. At this point they will already be familiar with their new in-class classmates and technology fellows having met them in the hypergroup and in other education classes this semester. The same hypergroup used this semester will be used in the second semester technology course. In the third semester, pre-service teachers will be out in various schools in the metropolitan area, the hypergroup will be available to them though the students will not be on the University campus. It has been decided that the hypergroup will stay intact for the students' duration through the PUMA program and into their first year as professional teachers.

Pre-service Teacher Reactions

Throughout the semester, for evaluation purposes, students have been periodically interviewed concerning their thoughts on various aspects of the new technology course. Overwhelmingly the response by hypergroup participants has been positive. Comments, such as, students are able find and share "a lot of ideas," and their ability to access "all the tech fellows," not just their section technology fellow, who were able to provide helpful advice and information, is considered a great resource. Students also reported that the hypergroup was a place for inquiring about their other education classes, that the large network of pre-service teachers all at various stages in their class work preparation, provided answers to their questions.

Conclusions

The technology fellows continue to participate by answering questions, developing mini lessons that are linked to the group, and supplying links to on-line tutorials and references for student use. The hypergroup is often referred to as a reference tool in class discussion. Originally, some of the students referred to the technology fellows as the experts, but as the semester commences students are realizing at times they are or other students can become the expert in a given topic area. The activity has been a great leveler for the group; the students and technology fellows interact as peers.

Hypergroups in the PUMA program are now not only seen by pre-service teachers in their technology course but due to their effectiveness they are becoming widely used throughout the college for many professors have now implemented a hypergroup in their educational methods courses.

The hypergroup, although a tool originally selected to assist students to meet a technology competency, will hopefully have a lasting effect on these future teachers, that of showing how technology can turn a negative, lack of communication among peers, into a positive.

An Assessment of Technology Skills and Classroom Technology Integration Experience in Preservice and Practicing Teachers

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Abstract: This study comprised the initial phase of a Preparing for Tomorrow's Teachers to Use Technology (PT3) funded investigation into the effects of integrating technology skills acquisition and preservice teacher methods courses on preservice teachers' use of technology during subsequent student teaching experiences. Two versions of a Technology Beliefs and Competencies Survey were administered, one for preservice teachers and one for practicing teachers. The results of baseline data on preservice and practicing teachers' technology skills and beliefs are identified and discussed. Also examined are preservice teachers' perceived technology barriers, and classroom teachers' technology integration practices.

Over the past decade, rapid advancements in technology have created expanding possibilities for enhancing instruction. As a result, there is a growing need for augmenting the instructional technology skills of both practicing and preservice teachers (Hill & Somers, 1996; Northrup & Little, 1996). Meeting those needs, however, has proven to be quite a struggle for many (Strudler & Wetzel, 1999). Siegel (1995) reported that most K-12 teachers are generally not receiving sufficient time, access, and support to become comfortable with computers, while others have found that although some teachers have positive attitudes toward technology, many do not consider themselves competent to teach with technology (Office of Technology Assessment, 1995; Schrum, 1999; Strudler & Wetzel, 1999).

Researchers have advocated integrating technology training throughout the preservice teacher education program (Brush, 1998). Although most teacher preparatory programs offer stand-alone technology courses for preservice teachers, many have not developed courses or curriculum that meet the International Society for Technology in Education (ISTE) standards. This is especially true in states lacking specific computer competencies for teacher certification. Therefore, many preservice teachers are still entering the classroom with minimum exposure to technology (Strudler & Wetzel, 1999).

With the support of a three-year Preparing Tomorrow's Teachers to Use Technology (PT3) grant, Arizona State University is investigating means for changing the way it prepares preservice teachers to meet current ISTE standards. This effort is focused on increasing both technology skills and technology-related instructional practices. Preservice teachers enrolled in the existing program are required to complete a one-credit, stand-alone technology course; the curriculum thus remains isolated from the environment in which it is to be applied. One goal of the PT3 grant is to investigate means for integrating the acquisition of technology skills with authentic teaching experiences. To achieve this goal, the stand-alone preservice teacher course addressing both technology skills and technology-related instructional practice is being eliminated in favor of integrating this content into three field-based courses covering instructional methods for teaching reading, math/science, and language arts/social studies. This field-based model, also known as job-embedded learning (Loucks-Horsley, Hewson, Love, & Stiles, 1997), is designed to provide preservice teachers with a combination of field-based technology workshops and authentic teaching experiences in real classrooms prior to their official student teaching assignment. A second goal of the project focuses on expanding the instructional technology skills and practice of teachers responsible for supervising the field-based, preservice teachers' classroom experiences. This is to be accomplished through the participation of practicing teachers in the field-based technology workshops.

This initial component of the PT3 funded project focused on collecting baseline data from preservice and practicing teachers regarding their technology skills and integration practices. This data will be used to inform the development of curricula designed to support more effective technology integration with preservice and practicing

teachers, as well as serve as a baseline to assess change in preservice and practicing teacher skills and attitudes over the course of the grant. The data collection process was aimed at addressing the following research questions:

1) What is the current state of technology experience and skills of preservice and practicing teachers?
2) Are there any significant differences in technology experience and skills between preservice and practicing teachers?

Method

Participants

Participants were 111 preservice teachers and 13 practicing teachers serving as supervising teachers within the field-based, preservice teaching program.

Procedures

Data collection occurred during November of 2000. Preservice teacher surveys were completed during methods course regular class sessions. Practicing teacher surveys were completed on an individual basis.

Instruments

Instruments consisted of two versions of the Technology Beliefs and Competencies Survey, one for preservice and one for practicing teachers. The preservice teachers' version consisted of the following four sections: Background Information, Technology Skills, Technology Beliefs, and Technology Barriers. The Background Information section contained five items covering such things as future teaching goal, academic year, frequency of computer use, and basic demographic information. The Technology Skills section included 32 Likert-style items ranked on a four-point scale from "I Can't Do This" to "I Can Teach Others How To Do This" covering the following six categories: basic computer operation, productivity software use, electronic communication skills, use of electronic references, World Wide Web utilization, and use of multimedia software and hardware. The Cronbach Alpha reliability for this section of the survey was 0.95. The third section, Technology Beliefs, asked participants to rank 11 Likert-style items regarding the integration of technology into classroom instruction on a four-point scale from "Strongly Disagree" to "Strongly Agree." This section had a Cronbach Alpha reliability of 0.86. The final section, Technology Barriers, contained nine Likert-style items asking participants to rank their perception of the importance of a variety of factors relating to successful technology integration in classrooms on a three-point scale from "Not a Barrier" to "Major Barrier." Cronbach Alpha reliability for this part of the survey was 0.78.

The practicing teachers' version of the survey also consisted of four sections. The first section, Background Information, contained 10 items regarding grade level assignment, years of teaching experience, school characteristics, frequency of computer use, and home Internet availability as well as basic demographic information. Sections two and three, Technology Skills and Technology Beliefs, were identical to the version used for preservice teachers. For the practicing teachers' version of the survey, the Cronbach Alpha reliability of the Technology Skills section was 0.96, while the value was 0.82 for the Technology Beliefs section. The final section, Technology Integration, included 10 Likert-style items asking participants to assess their use of technology to support lesson design and presentation on a four-point scale from "Strongly Disagree" to "Strongly Agree." The Cronbach Alpha reliability for the final section was 0.94.

Results

The reported results for this investigation are separated into four sections: Technology Skills for Preservice and Practicing Teachers, Technology Beliefs for Preservice and Practicing Teachers, Technology Barriers for Preservice Teachers, and Technology Integration for Practicing Teachers.

Technology Skills for Preservice and Practicing Teachers

Means and standard deviations of the responses for the six subscales of the Technology Skills section of the survey are reported in Table 1. Both preservice and practicing teachers identified Basic Operations (preservice M=3.04, SD=.61; practicing M=3.10, SD=.52) and Communications (preservice M=3.31, SD=.63; practicing M=3.15, SD=77) as the technology skills with which they felt most comfortable. There was also general agreement between the two groups on those technology skills with which they felt least comfortable. Multimedia was ranked lowest by preservice teachers (M=2.45, SD=.79) and next to lowest by practicing teachers (M=2.74, SD=.84), while World Wide Web technologies were ranked lowest by practicing teachers (M=2.56, SD=.74) and next to lowest by preservice teachers (M=2.73, SD=.65).

Within the Basic Operation subscale, preservice teachers felt most confident in their ability to print either selected pages, the current page, or complete documents (M=3.75, SD=.56), while they felt least confident in using anti-virus software (M=2.38, SD=1.00). Practicing teachers felt most confident in their ability to cut, paste, and copy information within and between documents (M=3.85, SD=.78), while they also identified using anti-virus software (M=2.31, SD=1.07) as the skill they felt least confident about.

On the Productivity Software subscale, preservice teachers felt most comfortable with basic word processor functions for text formatting, as well as spelling and grammar checking (M=3.84, SD=.45). They felt least comfortable in their ability to use graphics, transitions, animation, and hyperlinks within presentation software (M=2.23, SD=1.10). Practicing teachers felt most comfortable using advanced word processor functions such as headers, footers, tables, and inserting pictures (M=3.00, SD=.82), while also identifying use of advanced presentation software features as the thing they felt least comfortable with (M=2.15, SD=1.21).

On the Communication subscale, preservice and practicing teachers' rankings were in agreement, with both groups feeling most confident concerning the sending, receiving, opening, and reading of email (preservice M=3.85, SD=.45; practicing M=3.77, SD=.60), while subscribing to and unsubscribing from a listserv received the lowest confidence rankings for both preservice (M=2.77, SD=1.03) and practicing teachers (M=2.54, SD=1.13).

Preservice and practicing teachers' rankings on the Electronic References section were in agreement as well, with both groups feeling most comfortable performing keyword searches (preservice M=3.39, SD=.74; practicing M=3.00, SD=.91), while feeling least confident using advanced search features with Boolean operators (preservice M=2.68, SD=1.03; practicing M=2.54, SD=.88).

Concerning use of the World Wide Web, preservice teachers felt most comfortable using a web browser (M=3.75, SD=.50), while feeling least comfortable uploading webpage files to a server (M=1.81, SD=.95). Practicing teachers gave equal confidence rankings to using a web browser (M=3.38, SD=.77) and locating information on the Web using a search engine (M=3.38, SD=.96), while feeling least comfortable formatting web pages with tables, backgrounds, and links (M=1.62, SD=.87).

The final subscale of the Technology Skills section of the survey asked participants to rate their confidence with multimedia. Using basic features of a drawing program to create simple shapes was rated highest by both preservice (M=3.24, SD=.96) and practicing teachers (M=3.54, SD=.78). Preservice teachers felt least comfortable using authoring tools such as Hyperstudio (M=1.82, SD=.84), while practicing teachers felt least comfortable with photo editing of digital images (M=2.38, SD=.96).

Table 1: Technology Skill Survey Sections Reponses for Preservice and Practicing Teachers

Technology Skills	Preservice Teachers (N = 111)		Practicing Teachers (N = 13)	
	M	SD	M	SD
Basic Operations	3.04	.61	3.10	.52
Productivity Software	2.84	.66	2.80	.73
Communication	3.31	.63	3.15	.77
Electronic References	3.03	.75	2.77	.73
World Wide Web	2.73	.65	2.56	.74
Multimedia	2.45	.79	2.74	.84

Note. All responses ranged from 1 (I can't do this) to 4 (I can teach others how to do this).

Technology Beliefs for Preservice and Practicing Teachers

Technology Beliefs means and standard deviations are reported in Table 2. The numbers represent responses on a four-point Likert scale ranging from one (Strongly Disagree) to four (Strongly Agree). Both preservice and practicing teachers most strongly agreed with the statements, "I support the use of technology in the classroom" (preservice M=3.64, SD=.73; practicing M= 3.85, SD=.38) and "A variety of technologies are important for student learning" (preservice M=3.58, SD=.68; practicing M= 3.77, SD=.44). Both groups also gave the lowest ranking to the same statement, "Teaching students how to use technology isn't my job" (preservice M=1.80, SD=.73; practicing M= 1.62, SD=.65).

Table 2: Teacher Beliefs Reponses for Preservice and Practicing Teachers

	Statement	Preservice Teachers (N=111)		Practicing Teachers (N=13)	
		M	SD	M	SD
1	I support the use of technology in the classroom.	3.64	.73	3.85	.38
2	A variety of technologies are important for student learning.	3.58	.68	3.77	.44
3	Incorporating technology into instruction helps students learn.	3.52	.66	3.69	.48
4	Content knowledge should take priority over technology skills.	2.94	.79	3.00	.58
5	Most students have so many other needs that technology use is a low priority.	2.09	.66	2.23	.83
6	Student motivation increases when technology is integrated into the curriculum.	3.10	.63	3.38	.51
7	Teaching students how to use technology isn't my job.	1.80	.73	1.62	.65
8	There isn't enough time to incorporate technology into the curriculum.	2.08	.75	2.15	.99
9	Technology helps teachers do things with their classes that they would not be able to do without it.	3.15	.73	3.31	.48
10	Knowledge about technology will improve my teaching.	3.25	.78	3.46	.52
11	Technology might interfere with "human" interactions between teachers and students.	2.16	.70	2.08	.76
12	Technology facilitates the use of a wide variety of instructional strategies designed to maximize learning.	3.19	.76	3.31	.48

Note. Reponses ranged from 1 (Strongly Disagree) to 4 (Strongly Agree).

Technology Barriers for Preservice Teachers

This section of the preservice teacher survey included 10 Likert-style items ranging from one (Not a Barrier) to three (Major Barrier). Items perceived to represent significant barriers to technology integration included "Lack of or limited access to computers in schools" (M= 2.50, SD=.65); "Not enough software available in schools" (M= 2.49, SD=.63); and "Lack of knowledge about technology (M= 2.45, SD=.65). Preservice teachers identified the following statements as not representing barriers: "There isn't enough time in class to implement technology-based lessons" (M= 1.89, SD=.62); "Technology-integrated curriculum projects require too much preparation time" (M= 1.80, SD=.64); and "Lack of mentoring to help me increase my knowledge about technology" (M= 1.96, SD=.66).

Technology Integration for Practicing Teachers

In this portion of the practicing teacher survey, participants responded to 10 Likert-style items ranging from one (Strongly Agree) to four (Strongly Disagree) concerning their technology integrating practices. The practicing teachers most strongly agreed with the statement "I use technology to assist me with classroom management and record keeping activities" ($\underline{M}$= 3.46, $\underline{SD}$=.78). They gave an equal ranking to the statements "I integrate computer activities into the curriculum" and "Technology helps me meet the individual needs of a variety of students in my classroom" ($\underline{M}$= 2.92, $\underline{SD}$=.49). Practicing teachers identified the following two statements as least representative of their teaching practice: "I use technology to support project- and problem-based learning activities in my classroom" ($\underline{M}$= 2.54, $\underline{SD}$=.52) and "I encourage my students to use technology to demonstrate their knowledge of content in non-traditional ways (e.g. web sites, multimedia products)" ($\underline{M}$= 2.62, $\underline{SD}$=.77).

Discussion

Currently, technology training is a major focus of many preservice teacher education programs. That training is provided through a variety of different models, most of which are stand-alone technology courses that are not aligned with ISTE standards. This research describes the first component of a PT3 grant designed to move technology training of preservice teachers from the university classroom to a field-based model incorporating ISTE standards. This initial survey was designed to assess the current state of technology experience and skills held by preservice and practicing teachers.

Examination of overall subscale results for the Technology Skills portion of the survey revealed that both preservice and practicing teachers felt confident in their ability with electronic communication, a likely reflection of the increased use of email. Additionally, both groups were fairly confident in their mastery of basic computer operations.

Minor differences between preservice and practicing teachers were evident on two subscales: Electronic References and Multimedia. Preservice teachers rated their skills with Electronic References moderately higher than practicing teachers, which may represent students' greater familiarity with electronic databases commonly used within university libraries. Practicing teachers rated their Multimedia skills somewhat higher than preservice teachers which may reflect the long-standing availability of Hyperstudio in many elementary schools

Evaluation of individual survey items within the Productivity Software subscale indicated that both preservice and practicing teacher participants felt confident in their skills with word processors. They also felt comfortable using simple search strategies to locate information on the World Wide Web. Beyond these relatively commonplace activities, however, the survey revealed a low overall level of confidence with productivity software use. These results contribute valuable data upon which to base the designation of prerequisite skills for the field-based, preservice teacher experience. Further, by clarifying the technology skills largely lacking within this population, the survey serves to identify critical content for instruction within the field-based model. This baseline data is also useful for identifying baseline skills within the group of practicing teachers supervising the in-class portion of the field-based program. Including supervising teachers in the technology skills training supports their ability to serve as technology integration mentors for the preservice teacher population. Establishing baseline skills for the practicing teachers helps further define the technology related instructional goals and objectives within the field-based model.

Findings from the Teacher Beliefs portion of the survey revealed positive attitudes toward the importance of technology and technology skills in educational settings by both preservice and practicing teachers. Despite the relative lack of confidence identified in the technology skills' portion of the survey, both preservice and practicing teachers indicated a belief that teaching students how to use technology represented a valid expectation for elementary teachers and that there was sufficient time within the curriculum for that instruction. A belief in the importance of technology instruction coupled with a lack of technology skills represents an opportunity to impact instructional practice. By supporting the enhancement of technology skill levels, teachers may be better equipped to act on their beliefs regarding the importance of technology integration.

Preservice teachers completed the perceptions of Technology Barriers section of the survey. They indicated that their university assignments required the use of technology, however, they also indicated that a lack of technology knowledge and technology-integration techniques represented a major barrier to their integration of

technology in instruction. This suggests that university student technology use represents low-levels of competence or use of technologies unsuitable for providing preservice teachers with sufficient knowledge to support technology-based instruction. It further suggests that the technology use required of preservice teachers in their university classes failed to demonstrate meaningful ways to integrate technology within a curriculum. This inference is further confirmed by the overall low-level of skills identified in the Technology Skills section of the survey.

Results of the Technology Integration portion of the survey completed by practicing teachers revealed an apparent contradiction with their views expressed in the Teacher Beliefs section. Teachers expressed support for student technology use and the integration of technology into instruction. However, when responding to survey items specifying the nature of technology use in their classrooms, teachers reported their greatest use of technology for managerial and other non-instructional purposes, findings which support those reported by other researchers (Brush, 1998; Strudler & Wetzel, 1999). Participating teachers did indicate moderate use of technology in their instructional practice and by their students. However, the sample in this survey represented only 13 practicing teachers. As such, they are unlikely to constitute a representative sample upon which to base generalizations to the teacher population as a whole. As discussed previously, this apparent discrepancy between teachers' beliefs and behavior potentially represents an opportunity for impacting teacher practice through trainings on technology and integration techniques.

The discussion thus far has focused on the first of the research questions addressing the current state of technology skills and classroom technology integration experiences of preservice and practicing teachers. Overall findings indicate the technology skills of both groups were relatively low, while providing a basis upon which to delineate prerequisite skills and instructional objectives for the field-based model for teaching technology skills and integration practices. Due to the limited data collected from practicing teachers, comparisons between preservice and practicing teachers (the focus of the second research question) were not possible at this point. Additional data is currently being collected in order to make more meaningful comparisons.

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A Field-Based Model for Integrating Technology into Pre-Service Teacher Education

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Abstract: While most researchers agree that more technology training is needed for teachers, numerous suggestions exist in the literature regarding the content of the training and the methods for delivering the training. Many researchers believe that technology skills should be integrated with undergraduate methods courses, thus providing students with skills and experiences applying technology to their specific content areas. This field-based model is the basis for new undergraduate teacher education experiences at Arizona State University (ASU). The purpose of this paper is to provide an overview of a field-based model for integrating technology into pre-service teacher education; a model that provides pre-service teachers with opportunities to develop and implement technology-rich instructional activities in authentic teaching situations so that they leave ASU with the ability to integrate appropriate technologies in their future professional placements.

Introduction

There is little argument among leaders in the field of educational technology that teacher training institutions are not adequately preparing undergraduate teacher education students to effectively integrate technology into their teaching. Although the U.S. Department of Education and the National Education Association have stressed the importance of incorporating educational technology in pre-service teacher education programs (Ely, 1996), research continues to show that teachers feel they are not prepared to effectively use technology in their classrooms (Brush, 1998; Schrum, 1999; Strudler & Wetzel, 1999; Topp, Mortensen, & Grandgenett, 1995). Because of this, they continue to use computers for low-level, supplemental tasks such as drill and practice activities, word processing, educational games, and computer-based tutorials (Strudler & Wetzel, 1999; Willis, Thompson, & Sadera, 1999). Some researchers have even gone so far as to state that "...few teachers routinely use computer-based technologies for instructional purposes" (Abdal-Haqq, 1995, p. 1).

While most researchers agree that more technology training is needed for teachers, numerous suggestions exist in the literature regarding the content of the training and the methods for delivering the training. Many researchers believe that technology skills should be integrated with undergraduate methods courses, thus providing students with skills and experiences applying technology to their specific content areas. In a survey of innovative teacher education programs, Strudler and Wetzel (1999) discussed how teacher education institutions such as Vanderbilt and the University of Virginia were focusing on collaboration among methods faculty and educational technology faculty in order to provide pre-service teachers with experiences integrating technology into their teaching. These programs emphasized the need to provide pre-service teachers with technology training in *authentic* teaching situations. This field-based model, also known as *job-embedded learning* (Loucks-Horsley, Hewson, Love, & Stiles, 1997), focuses on providing pre-service teachers with authentic training experiences in real classrooms prior to their student teaching experiences. This model goes beyond the idea of integrating technology training with teaching methods courses; instead, pre-service teachers learn to integrate technology into their teaching as part of field-based experiences in real classrooms. Thus, instead of learning to integrate technology into hypothetical lessons required as part of a teaching methods class, pre-service teachers develop, implement,

and evaluate technology-rich lessons during field-based teaching experiences, with modeling and guidance from mentor teachers and university faculty.

This field-based model is the basis for new undergraduate teacher education experiences at Arizona State University (ASU). Based on the concerns discussed above, the College of Education identified three key components of a model designed to provide pre-service teachers with the skills and experiences required to fully integrate technology into their future classrooms. These components include:

1. Providing pre-service teachers with field-based, situation-specific technology training that they are able to integrate into the initial teaching activities they complete as part of their teaching methodologies experiences. These experiences are the major component of their teacher education program, beginning in their junior year (the first year they are in the teacher education program) and continuing until they are ready for student teaching.
2. Emphasizing the importance of technology integration in pre-service teachers' student teaching experiences by providing ongoing, field-based support to help them utilize technology in the activities they design for their classes, and including technology integration as part of the overall evaluation of their student teaching.
3. Providing College of Education faculty and field-based mentor teachers with training, guidance, and just-in-time assistance to both assist pre-service teachers with integrating appropriate technology into their teaching activities, and to evaluate the effectiveness of the integration activities.

The College of Education at ASU is committed to providing future teachers with the most innovative and effective training possible. This commitment includes the belief that technology needs to be infused into all aspects of teacher preparation and applied in authentic situations. This paper will provide an overview of a field-based model for integrating technology into pre-service teacher education; a model that provides pre-service teachers with opportunities to develop and implement technology-rich instructional activities in authentic teaching situations, and provides these individuals with guidance, support, and critical formative evaluation during their experiences so that they leave ASU with the ability to integrate appropriate technologies in their future professional placements.

The Traditional Technology Training Model

Prior to the Fall of 2000, pre-service teachers at ASU were required to participate in two technology experiences in order to graduate. The first experience was a general studies class that provided them with basic technology skills such as word processing, database and spreadsheet manipulation, and electronic mail and Internet usage. This class is required of all undergraduate students enrolled at ASU. The second experience was a series of courses specific to College of Education students. Each course emphasized different aspects of technology (e.g., technology basics, software integration, the Internet) and provided students with opportunities to develop, apply, and evaluate technology-based instructional materials specifically designed to be used in the classroom. Students completed activities relevant to the use of technology in their specific content areas and were evaluated on both knowledge of educational technology issues and selection and integration of appropriate technology resources.

Problems with the traditional model. Previous educational technology requirements for pre-service teachers at ASU were generally typical of requirements for many other teacher education programs. However, this model exposes problems regarding the relevancy of technology experiences students receive to the tasks and activities they will perform in the classroom. These problems include:

• *lack of integration between teaching methodology experiences and technology integration experiences.* Since the technology classes were taught as a series of three stand-alone modules, faculty had difficulty integrating the skills and experiences students acquire in the class with the experiences they are providing in their teaching methods classes. This tends to lead to a de-emphasis of technology integration into classroom activities once the students begin their initial teaching experiences.

• *lack of emphasis on technology integration in student teaching experiences.* Because the use of technology in teaching was not integrated into the overall teacher education program, there was little emphasis placed on the integration of technology into teaching and learning activities during pre-service teachers' student teaching experiences.

• *lack of training among faculty and field-based mentor teachers with regard to effective integration of technology with educational activities.* Since the required technology components of the teacher education program were primarily designed and delivered by the educational technology faculty, there were few opportunities for other teacher education faculty and mentor teachers to utilize many of the

innovative technology tools and resources designed for use in the classroom. Thus, it is not surprising that these individuals failed to demonstrate appropriate uses of technology to the pre-service teachers with whom they were working.

The Field-Based Model

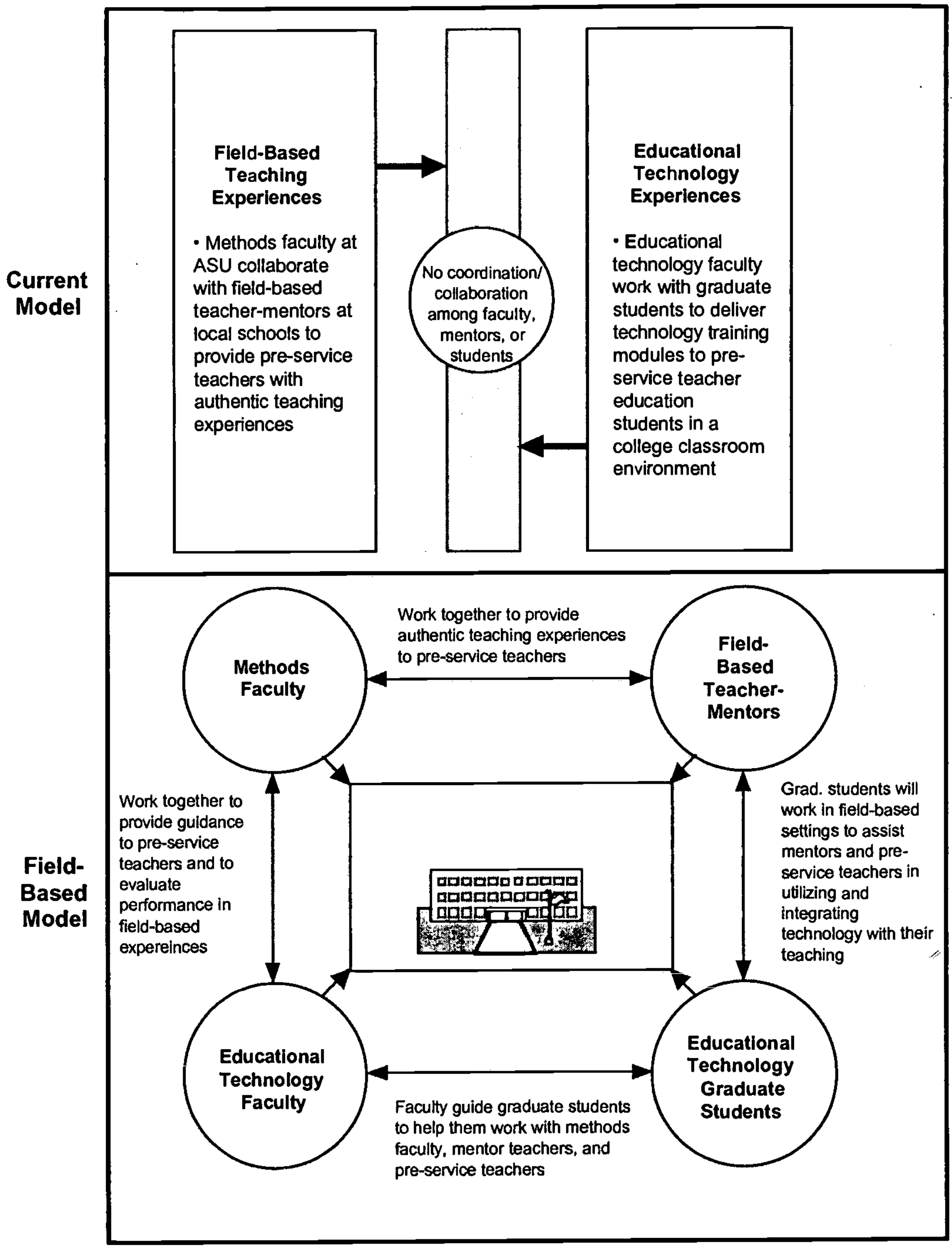
These concerns led to the development of a teacher training model that integrated technology experiences with field-based methods experiences in order to provide students with activities and experiences relevant to the tasks teachers perform in their classrooms. Implementation of this model required new roles for methods faculty, educational technology faculty, field-based mentor teachers, and graduate students (see Figure 1).

New roles for methods faculty and educational technology faculty. In the traditional model, methods faculty worked with field-based mentors to provide hands-on teaching experiences to pre-service teachers in authentic settings. Educational technology faculty, on the other hand, worked with educational technology graduate students to provide limited technology training to pre-service teachers in a less than optimal setting (i.e., a college computer lab). Thus, there was little if any interaction between methods faculty and educational technology faculty, particularly with respect to the types of field-based experiences provided to pre-service teachers. In this new field-based model, methods faculty team with educational technology faculty to develop projects and activities for pre-service teachers which focus on integration of technology into their field-based experiences. Educational technology faculty team-teach with the methods faculty to help pre-service teachers identify and integrate technology resources with activities they are currently completing, and implement and evaluate those resources in authentic teaching situations. Methods faculty and educational technology faculty work together to determine appropriate means for providing students with opportunities to apply technology in their teaching experiences, and collaborate on discussions of effective teaching methods and evaluations of student practice.

New roles for field-based mentor teachers and educational technology graduate students. In the traditional teacher training model, educational technology faculty worked with educational technology graduate students to provide pre-service teachers with minimal educational technology training in a college classroom setting. With the new field-based model, the educational technology graduate students work with field-based mentor-teachers in the local schools. Thus, each mentor-teacher has one to two graduate students with expertise in technology integration and utilization available in their classrooms, providing assistance to the pre-service teacher during the implementation of technology integrated instructional activities. This is the most important aspect of this new role for the educational technology graduate students: they are available to pre-service teachers and mentor-teachers at the point of instruction as opposed to in a classroom on campus. Thus, whenever an issue arises regarding educational technology, these individuals are available to help deal with any problems or provide their expertise. In addition, the educational technology faculty and the methods faculty provide the graduate students in the field with guidance and strategies for assisting pre-service teachers with technology integration activities.

New expectations for pre-service teachers. Through these new roles for key personnel involved in pre-service teacher education, the expectations for the utilization of technology by pre-service teachers have dramatically increased. Through the implementation of this model, pre-service teachers are expected to demonstrate the use of state-of-the-art technology in their teaching, and to understand how this technology can be leveraged to enhance numerous learning activities.

Figure 1. Field-based technology integration model.



Implementing the Model

Providing training and field-based support to pre-service teachers. In order to provide appropriate technology training for pre-service teachers, educational technology and methods faculty collaborated to develop a set of technology competency activities that would serve as a guide for both mentor teachers and pre-service teachers. The competency activities were aligned with the content covered in the field-based methods experiences (or "Blocks") so that the competencies could easily be integrated into the teaching activities pre-service teachers are required to perform as part of their methods experiences. The competencies included for Block I (language arts and social studies), for example, include:

- Drawing and Painting
- Desktop Publishing
- Digital Image Creation and Use
- Database Use and Advanced Searching
- Selection and Use of Computer-Based Educational Materials in SS and LA
- Classroom Management and Technology Integration in SS and LA

The competency guide is used by mentor teachers to provide appropriate activities to pre-service teachers during their field-based internships. In addition, the list of competencies serves as a guide to educational technology faculty and graduate students when determining the types of support pre-service teachers need as they complete required activities. For example, as stated above, one competency area for Block I of the elementary teacher education program is "Classroom Management and Technology Integration in Language Arts and Social Studies." In order to demonstrate this competency, pre-service teachers need to design a classroom-based activity sometime during the semester they are participating in Block I (see Table 1). To assist them with this activity, educational technology faculty and methods faculty present field-based training sessions dealing with effective methods for using technology with social studies and language arts topics. In addition, educational technology graduate students are available in the schools to assist pre-service teachers with designing and implementing their activities with students.

Table 1. Activity/assessment matrix for Block I technology competency.

Competency Area	Activity	Assessment
Classroom Management and Technology Integration in Language Arts and Social Studies • Describe plan for managing student accessibility to computers in the classroom • Design lab-based and classroom-based curriculum activities incorporating appropriate technology	Student will: • Design a classroom-based instructional activity for language arts or social studied incorporating technology. The activity will include: • A description of the activity • A description of the types of technology used in the activity • An educational rationale for using technology in the activity	Management/Technology Integration: ❒ Description of activity ❒ Description of technology used in activity ❒ Rationale for using technology

Providing training and field-based support to mentor teachers and methods faculty. Although many of the methods faculty and field-based mentor-teachers already possess exceptional skills in integrating technology with teaching, there is still the need to provide many of these individuals with additional training regarding effective uses of technology in various teaching domains, as well as available technology resources in those domains. Methods faculty and field-based mentors cannot be expected to possess knowledge of the vast number of resources available to them, and moreover, which of the resources are appropriate for various teaching and learning activities. This is the purpose of our intensive summer institutes. Working in collaboration with the partner schools, these institutes are led by teams of educational technology faculty and methods faculty, and focus on the content areas for each of the methods blocks. For example, instructors responsible for the social studies and language arts methods block

participate in workshops that specifically address the technology resources available in those content areas and provide instructors with hands-on opportunities to use the resources and discuss how those resources could be integrated into classroom activities. These institutes serve as opportunities for faculty and mentor teachers to learn about both the strategies for integrating technology into teaching and the vast technology resources available that teachers should be using with their students. With this ongoing training, methods faculty and mentor teachers are able to assist pre-service teachers in making informed decisions regarding effective technology integration during their field-based experiences.

In addition, ongoing support is provided *in the field* to methods faculty and field-based mentor teachers by the educational technology faculty and educational technology graduate students. Educational technology graduate students are continually placed in the schools to assist both pre-service teachers *and* field-based mentor teachers. These students have expertise in both teaching and technology integration; thus, they are able to assist the mentor teachers with activities they would like to attempt with their students, as well as activities the pre-service teachers are planning. This resource and support structure helps methods faculty and field-based mentor-teachers better model effective integration of technology into teaching and learning activities.

Summary

We are currently in the first year of our implementation plan for this new field-based model. During this year, we are implementing this model in three partner schools with 75 elementary education students and 75 mentor teachers. Our goal is to have the model implemented in all 12 of our partner schools (and all 300 of our pre-service elementary education students) by the Spring of 2002. We have already received enthusiastic responses from other teacher education programs at ASU (e.g., Special Education, Secondary Education), and have long-term plans to completely eliminate the stand-alone classroom-based technology classes in favor of the field-based model.

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Models of Technology Diffusion at Public Universities

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Abstract: "Preparing Teachers for the Digital Age: Implementing a Dynamic Model of Pedagogical Change" is funded by a PT3 grant from the U.S. Department of Education. Three public universities in rural Western Pennsylvania are infusing technology into the pre-service core curriculum and several teacher education programs. Together we place 1500 new teachers per year throughout the U.S. and abroad, guaranteeing that technology diffusion here will have significant impact. The obstacles we face are limited support staff, tight budgets, and faculty with little time for training. Appealing topics, incentives, and convenient formats address the lack of time. Incentives buy small technology items that departments cannot afford. The grant helps overcome the limited number of support staff by funding positions and facilitating peer mentoring. To succeed, it is also imperative to gain the buy-in of critical organizations. These strategies are increasing technology integration in teacher education, as intended in the grant.

A PT3 Project: Preparing Teachers for the Digital Age

"Preparing Teachers for the Digital Age: Implementing a Dynamic Model of Pedagogical Change" is a project funded by a $1.7 million PT3 grant (Preparing Tomorrow's Teachers to use Technology) from the U.S. Department of Education to the ADEPTT Consortium (Advancing the Development of Educators in Pennsylvania through Technology Training). The ADEPTT consortium is composed of Indiana University of PA, Clarion University of PA, and Edinboro University of PA—all public universities in rural areas of Western Pennsylvania. The universities provide excellent faculty-student ratios but have limited support staff. Both faculty and non-managerial staff are unionized.

The goal of this grant is to infuse technology into the pre-service teachers core curriculum and several teacher education programs. Technology infusion at these institutions will have a significant impact. Founded as normal schools, they have a tradition of teacher preparation. Together the consortium members graduate some 1500 future teachers per year placed throughout the U.S. and 7 foreign countries. At present, Pennsylvania does not have the demographics to place all of these graduates in state, guaranteeing that many alumni will work across the country. The economic boom of recent years has passed much of this area by, leaving persistent pockets of unemployment, encouraging out-migration, reducing enrollment, and tightening departmental budgets at these state-owned institutions. These recent economic and demographic trends, coupled with the high number of teacher education graduates, mean that many recent graduates must look outside of Pennsylvania for employment. We hope to make our students better prepared to work in all situations, giving them an edge on their competitors.

Three major goals of the PT3 grant are: 1) Instructional Technology will be moved from the periphery to the core of our curriculum. 2) Future teachers will apply and integrate Instructional Technology into the teaching/learning process. 3) Additional faculty, instructional designers, and technical support staff will assist. We aim to help faculty to recognize instructional objectives that can be more readily achieved using technology, to learn enough technical skills to model appropriate uses of technology in teaching, to assign and assess student work that incorporates technology use, and to consolidate these innovations into their syllabi.

In large teacher preparation programs, these goals seem daunting at first. There are many reasons why some college faculty members have been slow to integrate technology into their teaching. Some faculty are exhilarated by the change brought about from integrating technology in their teaching, while others are concerned about how technology impacts their authority, control of students, and their role as teacher (Cuban, 1999). Other reasons include: lack of suitable training, the time it takes to master the required skills (exacerbated by the need for teacher preparation faculty to spend time on the road in student teacher supervision), lack of technical support, lack of incentives, and the lack of hard evidence that technology can make their work move effective (Albaugh, 1997, Freberg, 1995, Olcott, 1999, Oppenheimer, 1997, OTA, 1995, Spotts, 1999). It is clear that getting faculty to use technology remains a challenge (Olsen, 1999).

So how can we succeed in achieving these goals? As we enter the second year of this three-year project, we have tried a variety of approaches and identified what works best at this stage in our educational environment. Five strategies we have been using are 1) classroom mentoring, 2) mini-grants and stipends, 3) innovative training formats, 4) K-12 to university modeling, and 5) gaining buy-in from critical organizations.

Telescoping Stages of Diffusion and Integrating Skills

Classroom mentoring is a multi-step process in which a technology mentor (colleague, student assistant, or technology specialist) first teaches a class while the teacher assists. Then the teacher teaches while the mentor assists. Finally the co-pilot departs, and the teacher can solo, teaching the new or revised unit without assistance. This training model was based on the work of Donald Schoen (1988). It also matches the model of coaching set forth by Podsen and Denmark (2000), where novices and first-year teachers observe and model the experienced teachers' lead as they plan and implement lessons. Structured opportunities to discuss and analyze are provided. The experienced teacher may also coteach a lesson with the novice and then have the novice teach a similar lesson. Coteaching provides guided practice where errors can be corrected before soloing, offers the opportunity to teach parts of a lesson before taking on the whole, and is an excellent device early in the learning process.

We have used classroom mentoring successfully in both the university and the K-12 contexts. For example, at Indiana University of PA and Clarion University of PA, grant faculty, graduate assistants and technology specialists have taught one or more classes within a course, designing them with varying degrees of collaboration from the responsible faculty member. Using this model, a variety of topics has been presented at IUP in many disciplines: PowerPoint for teaching Spanish language lessons in immersion curricula; PowerPoint to support second language writing; web authoring as a portfolio tool for math and art education classes; webquests and technology sandboxes for English and elementary education majors; spreadsheets as grade book and mind tools for introductory technology classes at the College of Education. Similarly, at Clarion, a technology specialist taught hands-on classes, with faculty members following up with an assignment requiring use of the same software. Classroom mentoring has given faculty members the chance to learn or review a technology in the context of their specific discipline and courses, empowering them to teach it themselves later.

At the IUP University School, a laboratory school, grant faculty have taught units integrating technology into the school curriculum. One long-term project has been the teaching of spreadsheets in fifth grade—they have been used not only in the obvious units on budgeting but also in social studies units on states and elections and science units on such topics as weather. Moreover, spreadsheets have been integrated with other software such as Inspiration and PowerPoint to teach organizational and communication skills. Here the master teachers, who have faculty status at IUP, as well as student teachers, observers, and pupils, all have the opportunity to learn and apply technology as an integral part of the school curriculum. Thus, we can address multiple audiences at one time (Adams 2000). Before Spring Semester 2001, we will apply this lesson in a new context, offering workshops for cooperating teachers and preservice teachers together. We hope to foster a collaborative relationship and lay the groundwork for the preservice teachers to use the same technology in their student teaching as they learn alongside inservice teachers in the workshops.

Best of all, this model makes it possible to address multiple stages of technology training and diffusion

almost simultaneously. Basic technology training, application of technology to teaching, and integration into the curriculum were conceived in the proposal as separate and sequential and, therefore, were expected to require an extended time frame (Sherry & Billig 2000). But in this model, they can all be addressed in project-based, integrated units like webquests, electronic portfolios, or newsletters. Moreover, project-based learning also addresses the issue of motivation. The audience has a clear idea of a relevant, appealing or needed objective, which gives them a compelling reason to learn the technical skills.

Similarly, the proposal conceptualized the training and teaching process as sequential: Faculty are trained, faculty model for students, faculty give students appropriate assignments, students do assignments, students go forth and use the skills in student teaching. Several parts of the training, modeling and diffusion process can also be addressed at once, however, in the revised model: e.g., faculty training, modeling to preservice teachers, preservice teachers observing inservice teachers, inservice teacher training, and/or preservice teachers using technology in their field experience can be combined. For example, the IUP faculty member in art education ultimately sat down with his students to learn web authoring skills for electronic portfolios, which will enable him to carry on more independently next semester. For a faculty member, the motivation becomes even stronger in this scenario—my students are learning the skills, so I had better learn them, too!

If You Feed Them, They Will Come!

It is an understatement to say that education faculty members at our institutions are extremely busy. Student teacher supervising, professional activities, a teaching load of four courses per semester, large numbers of advisees, and service obligations leave little time for professional development, not to mention for revamping one's entire approach to teaching. How can we motivate faculty members to learn and try technology in their courses? How can we make good use of the very limited time they are available for training?

At Indiana, Edinboro, and Clarion Universities of Pennsylvania, we sweeten the pot with incentives. Mini-grants are offered for technology related projects. Examples of funded projects included digitizing and editing video for use in social studies classes, using digital photography to record recently discovered paintings for use in art education classes, revising English education courses to use technology, purchasing interactive CD's for anatomy and physiology classes, attending an institute on technology in second language learning, adding the Internet and presentation requirements to courses in a variety of fields, and more.

Stipends are also provided for workshops, but they work best if part of the stipend is paid for attendance and the remainder is paid for demonstrating changes in syllabi and teaching. Prizes and coupons for prizes are given for completing mini-workshops. Food helps! Incorporating a meal within a long workshop or teaching circles provides both a much needed break and a chance to interact informally with peers and instructors.

What's in a Name?

Once we capture the attention of faculty with incentives, we offer a variety of training formats, topics and titles. Our formats range from individual consultation to short workshops, immersion workshops, technology sandboxes, and progressive workshops. (In the latter, faculty members earn coupons for each activity as they move among workstations in a lab. They can come for any part of the workshops, from 20 minutes to two hours, and complete as few or as many activities as they want. Coupons are turned in afterward for increasingly attractive prizes.) The format is adjusted to the time of year, with long workshops and immersion experiences offered during summers and breaks, mini-workshops and classroom mentoring during the semester, and stipends and individual consultation at any time. We rarely attract large audiences to any one event—varied schedules and demands on faculty make this unlikely. So it is we who need to be flexible, offering many formats for help and training. The burden is on us to be supportive and proactive, and to follow up with those faculty that do participate in a training event or incentive program.

Workshop content is another important factor. Although our faculty and K-12 teachers do attend generic workshops on individual software programs and their application in teaching, they show a far greater interest in workshops that are project based. For example, workshops on webquests or electronic portfolios are inherently related to teaching, meeting standards, and satisfying NCATE requirements. With NCATE

accreditation reviews just completed at Edinboro and starting shortly at IUP, the need for electronic portfolios has struck a chord among teacher preparation faculty. The most effective topics and titles are descriptive and concrete with clear outcomes, such as "Putting Technology in Your Syllabus." Catchy titles that are obviously relevant to schools also help, such as "Technology Sandbox" and "Technology Chalkboard."

At first glance, project-based teaching and learning seem more complex. They often require that multiple skills be taught and learned, which may appear confusing. Nevertheless, this very multiplicity can make them more effective. They inherently go beyond learning one limited skill to the creation of a product that can immediately be used. How many times in an application-by-application training program does the trainer long to teach how the various skills and applications can be integrated? How many times does the trainer actually get the chance to do so? Time often runs out at the end of the session or program, and integration is relegated to an afterthought. One key to success is to teach only basic, foundational concepts for each application or piece of equipment needed in the multi-skill project. Another strategy is to provide a set of generic templates that enable students to create the final product more quickly, but that can be modified and expanded so that students still learn all major aspects of creating the product themselves.

K-12 Models

Thanks to the presence of lab schools at two of our campuses, it is possible to have modeling not only by faculty to preservice teachers but also by inservice teachers to faculty and preservice teachers. Our laboratory school classes encourage such observation. Faculty, students and other teachers merely have to sign up to observe during a particular time slot.

In addition, the three universities have started teaching circles where faculty, inservice teachers and preservice teachers learn from each other about infusing technology into curriculum. Success is being achieved particularly where the local intermediate unit is actively involved, and where the event has both a professional and social dimension (e.g., dinner). The first IUP teaching circle appealed to multiple audiences by featuring a faculty member talking about using technology in early childhood classrooms and a K-12 teacher who spoke about certification as a technology resource person. Following the presentations were question-answer sessions and dinner. The second offered a panel of faculty, teachers and administrators who shared experiences with integrating technology into the curriculum. The catchy, concrete title "Putting Technology in Your Classroom" is the theme of this year's teaching circles.

You Have to Plug in to Be Wired!

In this grant, it has been critical to find the right organizations through which to publicize and demonstrate what we have to offer—to "plug in" to those existing organizations and networks. With the obstacles cited at our institutions, particularly the lack of time and attention for technology professional development, publicity and organization become essential. If faculty time is at a premium, how do we get their attention and prove that our programs and goals are worthwhile?

For example, as mentioned above, Indiana University of PA has experienced considerable success in establishing teaching circles by working with both its ADEPTT partners and the local intermediate unit (ARIN). Nearly 100 participants attended the first two teaching circles jointly sponsored by Indiana University of PA and the Armstrong-Indiana IU. ARIN already has a program of Academic Alliances, where faculty and teachers in the same discipline gather each semester for presentations and dinner. Building on this format, we created an Instructional Technology Academic Alliance. The first two meetings were of more general interest, but our April 2001 meeting will regain a disciplinary focus with an emphasis on the use of technology in teaching art and music. Publicity for the teaching circles is also a joint effort through ARIN, ADEPTT and the IUP PT3 grant, enabling us to reach all potential audiences.

Similarly, on our own campuses, it has been important to gain buy-in by working through established organizations and channels of communication (Durrington 2000). At Edinboro University of PA, which is smaller than IUP, the PT3 faculty and staff are working chiefly with two departments, which simplifies communication and support. They have made a systematic effort to promote services made possible by the grant, which has been effective in bringing faculty into training programs and securing administrative support. They also have a close relationship with their intermediate unit, which facilitates work with nearby districts.

At IUP, it has been a challenge to coordinate with a widely distributed network of grants, departments, and committees that are involved in teacher education or promote instructional technology. Our College of Education and Educational Technology does not house all the teacher preparation programs; many are housed in the specific disciplines scattered across campus. The need to identify and "plug in" to key organizations is even more critical in such a diverse environment. One such organization with which we have worked is the Teacher Education Coordinating Council. This council crosses college boundaries and includes representatives from all disciplines for which teacher certifications are granted at IUP. Getting these faculty involved in our training and incentive programs, keeping them informed, and discovering the values that will most motivate them to appreciate the use of technology in education has been critical. This is an ongoing endeavor that we are still perfecting as we write this paper. Other vital organizations have been the College of Education itself, through which we can identify and contact all needed audiences, and the ADEPTT Center (Advancing the Development of Educators in Pennsylvania through Technology Training, funded by Verizon), which offers K-12 and faculty training that complements PT3.

Reflections and Conclusions

Why do these techniques work best for us? Are there pitfalls that need to be addressed? In classroom mentoring, we must ensure that the teacher neither becomes dependent on the mentor nor stops trying to use technology. First and foremost, the sequence of observing, coteaching, teaching with assistance, and then soloing allows the faculty member to learn and take over gradually. While the mentor is teaching, we make sure that faculty members leave the role of teacher long enough to learn the skills and create some of the products themselves. Most of our mentees have already taken at least one technology workshop, which yields the same result. Further, it is useful to mentor or assist with the classes more than once so that the faculty member receives the benefit of repetition and review. The combination of repetition and co-teaching allows the mentee to assume increasing responsibility for the technology-enhanced unit. Some students can also be mentors (Gonzales et al. 1997; Beisser et al. 1997). Encouraging students to demonstrate their own expertise, since no one knows everything in the fast-changing world of technology, opens the door to another resource available in class. Providing materials, files, lesson plans, and templates gives faculty members a quick start when they are ready to coteach or solo. Finally, it is helpful to supply a safety net of resources and help after the faculty member has started soloing.

As stated, lack of time is a significant obstacle to technology diffusion in our environment. Busy faculty naturally want to know, "Why should I bother?" Thus, buy-in from faculty must be won. The more distributed the technology environment, the more important it is to identify and win over the key organizations that will need to buy into the project. Relevant and appealing topics and demonstrations, incentives and prizes, and convenient formats can also help to gain buy-in and overcome the obstacle of lack of time.

Incentives are especially helpful in our environment because departments and colleges at these public universities have extremely limited budgets. This lack of funds makes it difficult to acquire even small items like scanners and webcams or to travel for professional development. Our incentives help fulfill these needs. The grant has also helped to overcome the extremely limited number of support staff on these campuses, by funding additional positions, by putting student expertise to work, and by facilitating peer mentoring. These strategies are helping us reach our goal of infusing technology in teacher education courses, as intended in the grant.

The ability to telescope the anticipated stages of training and diffusion will be a key factor in reaching our goals within the limited timeframe of the PT3 grant. If we truly had to teach faculty, then have them model technology use for students, next make technology assignments to students, and only then hope to see graduates take the lessons with them into their student teaching and careers, three years would not be an adequate length of time. If we really had to wait for each skill, piece of equipment, or application to be mastered before applying them to teaching or integrating them with each other or into curriculum, time would again be an insurmountable obstacle. The realization that these "stages" can be telescoped is a vital timesaver that will make success feasible.

Our final challenge is to see that technology continues to be infused after the PT3 grant ends. Apart from seeking other grants, what assurances can we offer? We hope that by making faculty comfortable with technology, providing basic skills, and illuminating compelling reasons to use them, we will have changed the faculty sufficiently to carry on when the grant is complete. Their technology foundation will already be established, and the permanent staff will need only to maintain and update this foundation. Even more

importantly, the syllabi of record for many teacher preparation courses will be changed as a result of the grant. By coordinating with established organizations that will remain after the grant, we hope to have a continuing influence. Finally, the institutions in the consortium have made a clear commitment to stay in the technology mainstream, which will ensure an environment in which technology plays a prominent role. All of these factors will make it possible for the PT3 grant to have a lasting impact.

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Technology Standards for Preservice Teachers: Where are We Headed?

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Abstract: This presentation is a discussion of the implications for preservice teacher education programs of (a) the new National Educational Technology Standards for Teachers (NETS), (b) the Commitment to Technology indicator within the NCATE 2000 Standards, and (c) the new Colorado Technology Standards for Preservice Teacher Education Students. The standards will be discussed from the national perspective and from the perspective of the responses of one institution to the standards through a Preparing Tomorrow's Teachers to Use Technology (PT3) grant.

The use of technology in K-12 classrooms has received a great deal of positive praise in several recent reports. Technology is presented as a means to improve schools and to raise student achievement. Federal policies and many state policies have lead to an infusion of technology into school classrooms across the country. A National Center for Educational Statistics (2000) study showed that 95% of public schools had Internet access in 1999. Although there has been a major investment in technology for K-12 schools, the actual utilization of this technology has been somewhat disappointing. Although 65% of teachers had Internet access only 20% were using advanced telecommunications in their teaching (NCES, 1997). A study by Persichitte, Tharp, and Caffarella (1997) showed that although the technology is readily available in teacher education programs, only 45% of faculty members regularly use technology during class and only 40% of the students are required to design and deliver instruction incorporating various technologies.

Technology Needs of Preservice Teachers

The National Educational Technology Standards for Teachers (NETS) were created under the direction of the International Society for Technology in Education (2000). There are six standards including (a) Technology Operations and Concepts, (b) Planning and Designing Learning Environments and Experiences, (c) Teaching, Learning, and the Curriculum, (d) Assessment and Evaluation, (e) Productivity and Professional Practice, and (f) Social, Ethical, Legal, and Human Issues. The six standards are presented for various stages in a preservice teacher education student's program as a development process with full proficiency for the first year as a classroom teacher. The developmental profiles are (a) General Preparation Performance Profile, (b) Professional Preparation Performance Profile, (c) Student Teaching/Internship Performance Profile, and (c) First-Year Teaching Performance Profile.

The new National Council for Accreditation of Teacher Education (NCATE) 2000 Unit Standards indicate that technology should be a significant part of the conceptual framework for all teacher education programs. "A conceptual framework(s) establishes the shared vision for a unit's efforts in preparing educators to work in P-12 schools" (p. 3). The Commitment to Technology within the conceptual framework

> . . . reflects the unit's commitment to preparing candidates who are able to use educational technology to help all students learn; it also provides a conceptual understanding of how knowledge, skills, and dispositions related to educational and information technology are integrated throughout the curriculum, instruction, field experiences, clinical practice, assessments, and evaluations. (p. 4)

As teacher education programs undergo NCATE reviews, they are required to show how technology is integrated throughout courses and programs.

The needs reflected above on a national level are indicative of the needs within the State of Colorado. The Colorado Legislature recently passed Senate Bill 99-154, *The Standards-Based Teacher Education Act of 1999*. This act includes a provision that "each candidate for a provisional teacher license shall have and be able to demonstrate . . . the ability to integrate technology into instruction at the grade level for which the teacher expects to be endorsed."

In response to Senate Bill 99-154, the Colorado State Board of Education enacted eight standards for licensing of teacher education candidates. The seventh standard is, "Knowledge of Technology" and is defined as, "The teacher is skilled in technology and is knowledgeable about using technology to support instruction and enhance student learning." The standard requires that the teacher has demonstrated the ability to (a) Apply technology to the delivery of standards-based instruction, (b) Use technology to increase student achievement, (c) Utilize technology to manage and communicate information, (d) Apply technology to data-driven assessments of learning, and (e) Instruct students in basic technology skills. This standard and the five indicators are focused on the effective application and utilization in K-12 classroom settings.

Response by One University

The convergence of these national and state recommendations and requirements provided a window of opportunity at the University of Northern Colorado (UNC) to make technology a central component of the preservice teacher education programs. The availability of support under the U.S. Department of Education Preparing Tomorrow's Teachers to Use Technology (PT3) provided the resources to facilitate the changes.

There are three overarching goals of the UNC PT3 project that will guide the project over the next three years. The goals are as (a) Graduates of the UNC teacher education programs will effectively utilize technology for instruction in their classrooms when employed as full-time teachers, (b) UNC student teachers will effectively utilize technology for instruction in the partner school classrooms, and (c) UNC teacher education faculty members will effectively utilize technology for instruction and model appropriate technology use for the preservice teacher education students.

These three overarching goals will be achieved through five initiatives designed to bring about systemic change within the teacher education programs of the University of Northern Colorado. The five initiatives are (a) Enhance the required educational technology courses for students in the professional teacher education programs, (b) Model appropriate technology use and integrate technology utilization in the general education and content area discipline courses, (c) Model appropriate technology use and integrate technology utilization in the general education and content area discipline courses, (d) Integrate technology use by preservice teacher education students in partner schools, and (e) Build a model for the effective use of technology in preservice teacher education programs. The project has been underway for five months with activities under all five initiatives that over time will change the way technology is used in the preservice teacher education programs.

The need for well prepared, technology proficient teachers who know how to infuse technology into the curriculum has been identified at the national level and also exists at the Colorado level. To effectively utilize technology in the classroom, preservice teacher education students must know both how to operate various technology systems and how to integrate that technology into their classrooms.

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PT3: Changing the Climate for Technology in an EdSchool

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Abstract: This paper describes the results of efforts to enhance the technology components of the undergraduate teacher education program at Georgia Southern University. Preparing Tomorrows Teachers to Use Technology (PT3) provided incentive to faculty through increased access to hardware and software, faculty support and mentorship by technology proficient teachers, release time to assist in the course and curriculum development process, technology training for pre-service teacher education faculty and demonstration teachers in K-12 schools, and mini-grants to pre-service teacher education faculty to enable significant change to the pre-service curriculum. Results showed that these efforts could increase the quantity and quality of the technology use in pre-service teacher training.

Background

Pre-service teachers will be the teachers of the 21st century. As such, they must develop the necessary technology knowledge and skills to prepare the next generation of students. Pre-service education systems have struggled to keep up with the rapidly changing pace of technology development (Moursund & Bielefeldt, 1999). Willis and Mehlinger (1996) while reviewing the literature on information technology and teacher education found that, "Most pre-service teachers know very little about effective use of technology in education ... the virtually universal conclusion is that teacher education, particularly pre-service, is not preparing educators to work in a technology-enriched classroom" (p. 978).

National, state, and local analyses all come to the same conclusions concerning the use of technology in teacher education (Carlson, et al., 2000). Overall these studies recommend that:

- Technology should be integrated into all courses that pre-service teachers take.
- Institutions of higher learning should identify examples of technology integration for all courses that pre-service teacher take.
- College faculty, that teach pre-service teachers, should model effective uses of technology in their classroom.
- Pre-service teachers need more opportunities to apply Instructional Technology during their field

experiences under qualified classroom supervision.

Research Goal

This paper describes the results of efforts to enhance the technology components of the undergraduate teacher education program at Georgia Southern University. One of several goals of the College's participation in the Preparing Tomorrows Teachers to Use Technology (PT3) grant funded by the U. S. Department of Education was to recommend revisions of the pre-service curriculum and the course content by integrating technology into the learning process. Educators agree that engaging students in learning experiences that are inquiry-based, problem-centered and integrative, enable students to understand concepts much more deeply than mere memorization. PT3 provided incentive to faculty through increased access to hardware and software, faculty support and mentorship by technology proficient teachers, release time to assist in the course and curriculum development process, technology training for pre-service teacher education faculty and demonstration teachers in K-12 schools, and mini-grants to pre-service teacher education faculty to enable significant change to the pre-service curriculum. Additionally, an expectation for technology use and integration was established throughout the college.

Research Design

This study was designed to determine if the PT3 project would increase the infusion of technology in the courses taught in the pre-service teacher-education program. The research design used in this study was both qualitative and quantitative. The qualitative method used was content analysis (Patton, 1990). In this method the researchers identify, code, categorize, and classify the primary patterns in the data. The primary purpose is to simplify the complexity of reality into some manageable classification scheme. Once the content was codified, quantitative analysis was conducted using a pre/post design. The population for this study included all syllabi used for instruction during Fall 1999 and Fall 2000. Course syllabi were analyzed for technology use and integration in Fall 1999, before the project was implemented, and in Fall 2000, after project implementation. First, the number of references made to Instructional Technology in each syllabus was determined. This provided the researchers with a sense of the awareness of technology in each syllabus. Second, the researchers wanted to know how technology was used in the classroom. Each syllabus was carefully analyzed for instances where the use of instructional technology was required or included. Each instance was then classified into one of three categories: teaching, learning, and research. Finally, the researchers wanted to determine the quality of technology integration demonstrated in each syllabus. Using The Apple Classrooms of Tomorrow (ACOT) research findings that the introduction of technology into classrooms can significantly increase the potential for learning, especially when it is used to support collaboration, information access, and the expression and representation of student's thoughts and ideas. ACOT developed a taxonomy of technology integration to clarify those ideas (http://www.apple.com/uk/education/acot/acotresearch.html). These criteria were used to classify each syllabus

Results

As a means of defining the current status of the integration of technology in the instruction of pre-service teachers, course syllabi were analyzed. Copies of course syllabi used for instruction with pre-service teachers were obtained from three departments (Early Childhood Education and Reading (ECER), Middle Grades Education (MGED), and Secondary Education (SCED). Table 1 lists the number of syllabi that were analyzed by department and semester. Twenty-one courses were analyzed both in Fall 1999 and 2000. Only when the exact course (identified by course number) was taught in both semesters was there a matched pair that. There were courses taught in the Fall 1999 that were not taught in the Fall 2000 and visa versa.

Department	Fall 1999	Fall 2000
Early Childhood Education & Reading	12	20
Middle Grades Education	6	5

Secondary Education	7	6
Total	25	31

Table 1: Number of Course Syllabi Analyzed

References to Technology

The number of references made to Instructional Technology is presented in Table 2. There were 121 references made to technology use in the 25 syllabi analyzed during the Fall 1999. After implementing the PT3 project, 298 references were made in 31 syllabi.

Department	Fall, 1999		Fall, 2000	
	N	n	N	n
Early Childhood Education & Reading	33	2.8	152	7.6
Middle Grades Education	14	2.3	53	10.6
Secondary Education	74	10.5	93	15.5
Total	121	4.8	298	9.6

Table 2: References To Instructional Technology in Course Syllabi;
N= total references n= references per course

There was a 59% increase in the number of references made to Instructional Technology after the implementation of the PT3 project. These were not evenly distributed among the three departments. Early Childhood Education and Reading and Middle Grades Education made the greatest gains in terms of total references – an increase of over 70%, while Secondary Education posted a 20% gain. The percentage gains in total references were somewhat misleading, however, because Secondary Education had the most references to technology in the Fall 1999. A modest percentage gain of 20% in total technology references boosted the references per course to a substantial 15.6, while ECER and MGED had lower per course averages.

The Paired-Samples T-Test procedure was used to determine if there were statistical gains for the combined pre-service teacher programs. The result of the t-test, as shown in Table 3, revealed that there was a significant difference between the number of references in the Fall 1999 as compared to references in the Fall 2000 (p= .000).

	Mean Differences	Std. Dev.	Std. Error	t	df.	Sig. (2-tailed)
IT References – Fall, 1999 IT References – Fall, 2000	-6.52	5.94	1.30	- 5.035	20	.000

Table 3: Paired Samples Test Between IT References during Fall 1999 and Fall 2000

Instructional Technology Use

Using content analysis, each syllabus was analyzed to determine how Instructional Technology was used. Technology use was classified into three categories:

1. **Technology used in teaching** – Applying computers and related technologies to support instruction in the classroom. For example, using technology for planning and delivering instructional units that integrate a variety of software applications and learning tools; and develop technology lessons that reflect grouping and assessment strategies for diverse populations.
2. **Technology used in learning** – Using computer-based technologies such as telecommunications and the Internet to enhance personal and professional productivity. For example, using software application packages to solve problems and assist in decision-making, collect data, manage information, make presentations, and develop an understanding of how technology is used to improve education.
3. **Technology used in research** -Using computer-based technologies such as telecommunications and the Internet for research.

Table 4 reports how technology was used in the Fall 1999 and 2000. Totals differ slightly from those in Table 2 because there were occasions in which references to technology could be counted but the context was

insufficient to classification the intended use of the technology. For example, a URL could have been listed in the syllabus but it could not be determined exactly how the URL was to be used. Thus the number of references is greater than the number which was classified. Applying computers and related technology through teaching was the most frequent use of technology, while using technology for research was the least frequent use.

Of the 117 references made to using Instructional Technology in the Fall 1999, seventy-two percent were references to using technology in teaching, eighteen percent were references to using technology in learning and ten percent were references to using technology in research. After the implementation of the PT3 project 273 references to Instructional Technology were made. Sixty-seven percent of the references were made to using Instructional Technology in teaching, twenty-seven percent in learning, and six percent in research.

Department	Categories of Use						Total	
	Teaching		Learning		Research			
	99	00	99	00	99	00	99	00
ECED	19	84	8	27	8	10	35	121
MGED	9	37	4	15	1	0	14	52
SCED	56	62	9	31	3	7	68	100
Total	84	183	21	73	12	17	117	273

Table 4: Technology Used in Pre-Service Training in Fall 1999 and 2000

The use of Instructional Technology both increased and shifted after the implementation of the PT3 project. While the overall use of instructional technology increased from 117 to 273, an increase of 57%, the results of the paired sample t-test revealed that there was a significant differences between the use of technology in teaching (p= .001) and in learning (p=.046) but not for research (p=.526). The use of technology in teaching increased from 84 to 123 (54%) and the use of technology in learning increased from 21 to 73, a seventy-one percent increase. The use of technology for research did not increase significantly but it did increase from 12 to 17, a 29% increase. After the PT3 project was implemented, one can conclude that the use of instructional technology in teaching and in learning increased significantly.

	Mean	N	Std. Dev.	Std. Error Mean
Teaching 1999	3.62	21	5.62	1.23
Teaching 2000	7.90	21	5.89	1.29
Learning 1999	0.86	21	0.91	0.20
Learning 2000	2.57	21	4.12	0.90
Research 1999	0.52	21	0.81	0.18
Research 2000	0.67	21	0.97	0.21

Table 5: Paired Samples Statistics in Fall 1999 and 2000

	Paired Differences Mean	Std. Dev.	Std. Error Mean	T	df	Sig. (2-tailed)
Teaching 1999 Teaching 2000	4.29	5.03	1.10	-3.903	20	.001
Learning 1999 Learning 2000	1.71	3.69	.81	-2.129	20	.046
Research 1999 Research 2000	0.14	1.01	.22	-0.645	20	.526

Table 6: Paired Samples Test between Teaching, Learning, and Research Fall 1999 and 2000

Integration of Technology

Using content analysis, each syllabus was analyzed and assigned a level of technology use according to a criteria adapted from the ACOT Study (http://www.apple.com/uk/education/acot/acotresearch.html). The criteria used were:

Entry	Little or no evidence of use of technology
Adoption	Some evidence of technology being incorporated into the teaching, primarily to teach **about** technology and as a means of delivering traditional instruction.
Adaptation	Evidence of integrating technology into the traditional teaching methods, however, classroom instruction is still primarily traditional.
Appropriation:	Pervasive use of technology. Integration of a variety of types of technology.
Invention:	Evidence that teacher and students are experimenting with new instructional technology. The entire teaching/learning experience is transformed with the use of technology being almost transparent.

Of the 25 syllabi analyzed in the Fall 1999, 92% indicated little evidence of technology use. These were divided into forty-eight percent that showed little of no evidence of technology (e.g. Entry Level) and forty-four percent that showed some evidence of technology being incorporated into teaching (e.g. Adoption Level).
After the implementation of the PT3 project, 31 syllabi were analyzed using the same ACOT criteria. Twenty-one of the syllabi were for the same courses used in the proceeding fall. The remaining ten were different courses.

While twenty-two percent of the syllabi showed little or no evidence of technology use (e.g. Entry) after the implementation of the PT3 project, eighty-eight percent of the syllabi showed evidence of using technology. Thirty-six percent of the syllabi indicated some evidence of technology being incorporated into teaching (Adoption), although most of the technology was used primarily to teach about technology and was used as a means of delivering traditional instruction. Twenty-nine percent of the syllabi were judged to have integrated technology into the traditional teaching method (e.g. Adaptation). Thirteen percent of the syllabi were judged to have pervasive use of technology indicated by the integration of a variety of types of technology (e.g. Appropriation).

ACOT Level	Fall 1999		Fall 2000	
	N	%	N	%
Entry	12	48	7	22
Adoption	11	44	11	36
Adaptation			9	29
Appropriation	2	8	4	13
Invention				
Total	25	100	31	100

Table 7: Changes According to the ACOT Study Criteria

SUMMARY

This study focused on the infusion of Instructional Technology in the pre-service teacher training courses. First, the study examined the number of references made to Instructional Technology in course syllabi before and after the implementation of the PT3 project. There was a fifty-nine percent increase in the number of references made to technology. A paired t-test revealed that this difference was significant (p=000).

The references to instructional technology were further analyzed to determine how technology was designed to be used in each syllabus. Each reference was classified into three categories according to its use of technology. The categories were (1) technology in teaching; (2) technology in learning; and (3) technology in research. Overall, the use of instructional technology in teaching increased fifty-four percent; the use of technology in learning increased seventy-one percent; and the use of technology in research increased twenty-nine percent. A paired samples t-test determined that there was a significant differences between the use of technology in

teaching (p=.001) and the use of technology in learning (p=.046); however the differences for the use of technology in research was not significant.

Finally, the study assessed how Instructional Technology was being infused into the pre-service teacher training courses. A careful content analysis of each syllabus was completed and a level of technology integration was determined. The criterion for determining technology integration was derived from the ACOT studies. Before the implementation of the PT3 project, 92% of the syllabi were determined to have little of no evidence of technology integration (e.g. Entry or Adoption). After the PT3 project this percentage dropped to fifty-eight percent. In addition, technology infusion was judged to have improved as indicated by the number of syllabi that demonstrated evidence of technology use: Adaptation-29%; Appropriation-13%. While these results are far from ideal, significant improvement in technology integration was demonstrated is a relatively short period of time.

Conclusions

According to the SEIR*TEC study (1998), pre-service education students often do not know how to integrate various technologies into their teaching. One place to help remedy this problem is in the pre-service teacher training classroom. This PT3 project demonstrated that pre-service teacher training courses could infuse more technology into the course syllabi. By the end of the project there was a 59% increase in the references to technology, a 57% increase in the uses of technology and an overall improvement in the quality of technology infusion in course syllabi.

The PT3 project brought about some measurable improvement in the use of technology, and an awareness of the need for technology infusion in the pre-service teacher training program. This study provides the following observations:

1. This project showed that an organized program with definite goals and a systematic approach could increase the quantity and quality of the technology use in pre-service teacher training.
2. ECER showed greater numerical gains because of a program-wide approach to technology addition to the syllabus. The other programs did not show the great percentage or numerical gains because they were working with smaller numbers of syllabi or started with a higher use of technology.
3. Teaching is by far the largest technology integration activity.
4. Research is not something that is utilized much in pre-service teacher training syllabi. Faculty may consider that as a way to increase technology integration in their courses.

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Working Side by Side: Preservice Teachers & Children Meet at the Computer

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Abstract: This paper describes the effects of an after-school program where preservice teachers and elementary school children play and work together using computer games and other technologies and then complete activities based on those games. The program, based on the 5th Dimension, a project developed at the University of California, San Diego, is designed to give preservice teachers experiences using and evaluating a variety of technologies. It also, of course provides preservice teachers with opportunities to get to know children, learn to interact with them and guide their learning. The enthusiasm of the children often helps sometimes technologically-reticent college students. The paper will describe the project and highlight how this experience can help preservice teachers begin to meet national standards for new teachers.

Introduction

It's 3:00 … and just as most of the school empties, one classroom comes alive. Two dozen youngsters rush in, anxiously looking for their buddies from St. Bonaventure. The college sophomores and juniors greet the elementary school students, and each buddy team immediately picks up from where they left off a couple of days ago. The partners check to see what they have completed and then decide what activity they will do today. Most choose a computer activity, so they find the right CD, read the activity card to find out what they must accomplish, and then get to work. The software is installed (often it's the fourth grader leading the college student in this effort), directions are read, and play begins. One pair traverses the *Oregon Trail*, while another tries to design products in a *Factory*. Others are taking digital photos for the web site or a *PowerPoint* presentation.

This is an afternoon in the *WOLF Den* an after-school program that is running at East View Elementary School in Olean, NY, as part of the PT^3 (*Preparing Tomorrow's Teachers to Use Technology*, www.pt3.org) project at St. Bonaventure University (SBU). (The wolf is the University mascot, and of much interest to local children.) College students who run the program are just starting courses as elementary education majors. SBU's School of Education Conceptual Framework emphasizes that preservice teachers learn best in realistic and practical settings where theory is developed in context. That belief holds true not only for traditional methods courses, but also for helping preservice teachers learn about using technology to support teaching and learning. We have integrated experiences with technology across the entire undergraduate teacher education program – across all courses and field experiences – rather than situating learning about technology in a single course.

The WOLF Den – Where Outside Learning is Fun – is a local version of the 5th Dimension, a mixed activity system of education and play designed to provide a context in which undergraduates have opportunities to connect theory with practice. It also provides contexts for children to master knowledge and skills. The 5th Dimension was conceived by Dr. Michael Cole of the University of California, San Diego, and its many varieties are documented in an online Clearinghouse developed by William Blanton at the Appalachian State University (http://129.171.53.1/blantonw/5dClhse/clearingh1.html).

There are several goals for the program. For the children, it provides opportunities to engage in learning-related tasks; it gives them one-to-one attention from adults who engage with them in conversation – on one level about games and activities, but on another level about problem solving; it is a safe, secure environment where the after-school hours can be fun and productive, often providing a haven for children who otherwise go home to empty houses. As with all of our field-based programs, children's learning is most important, but the goals for our preservice teachers drive the design of the program. In the WOLF Den preservice teachers are in a situation where they have to learn software and hardware, where they have to troubleshoot technology problems (printers, disks, cables, system settings, etc.). They have to read cryptic manuals and manage demanding children at the same time.

As a core part of our PT[3] project, the WOLF Den provides an environment where preservice teachers can gain experience using a variety of technologies, where they can interact with children using those technologies, and begin to see the effect on children's learning.

This paper will describe the WOLF Den and the experiences that it provides for preservice teachers. It will look at how experiences in the WOLF Den help preservice teachers begin to meet National Educational Technology Standards for Teachers and INTASC (Interstate New Teacher Assessment and Support Consortium) standards for new teachers. We will report data gathered from the preservice teachers, reactions from the children and ethnographic data collected by observers.

Description of the Program

The WOLF Den is an after-school program that brings college students (whom we call tutors) and elementary school children together in computer-mediated play and learning environment. The central artifact in the WOLF Den is a table-top maze, and the goal for the participants is to complete an activity in each room of the maze. Each maze room points participants to a choice of activities, one of which must be completed before passing through the room. Most activities are computer-based (play a game, create a presentation) or technology related (take digital pictures, make a video), but there are also non-computer activities (board games) that fill the gaps when all of the computers are in use. All activities have task or activity cards at three levels specifying what must be accomplished. (See Figure 1 for a sample activity card.) The beginner level requires players to complete a relatively simple task – play the game at its most basic level, for example. This is important since we have participants as young as seven years old, and they must have success. The good level generally requires more time and effort and a higher level of achievement; and the expert level is really challenging. Each child starts a trip through the maze using a simple token or "cruddy creature" to mark his/her place. One goal (which is extremely motivating for children) is to transform the "cruddy creature" into an "excellent creature" (a fancier, more desirable toy or token) – which requires completion of 11 games at the good or expert level.

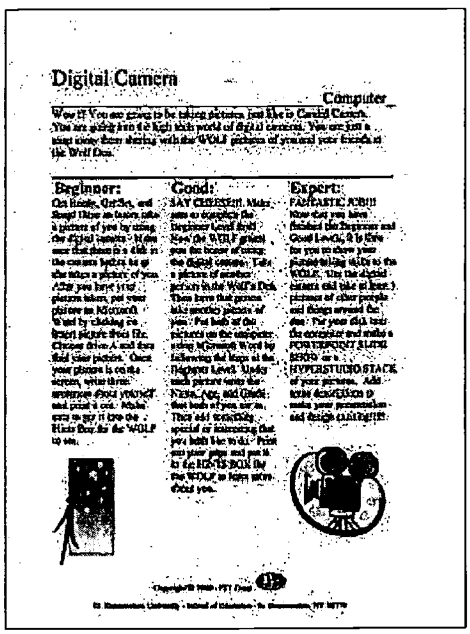
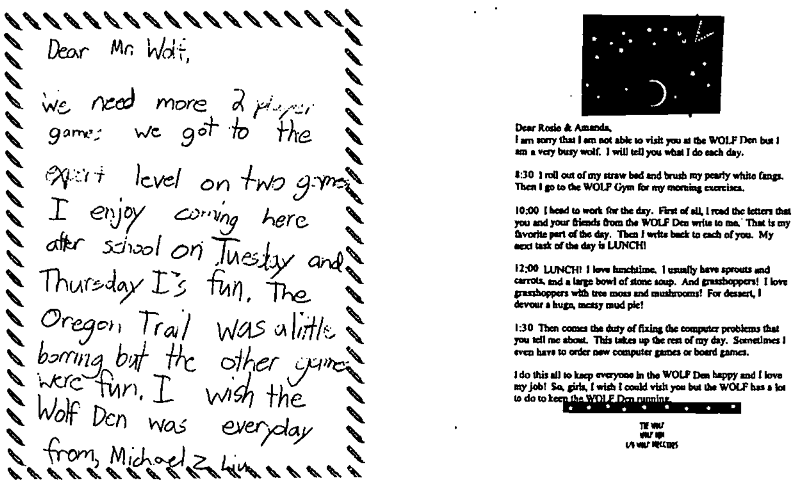


Figure 1: Sample Activity Card

The WOLF Den is run by graduate assistants and a mythic figure – the Wolf, of course. The Wolf is a non-present participant who oversees the program and who is, ostensibly, responsible for upkeep, organization and creation of rules. The children can communicate by mail with the Wolf, expressing pleasure or frustration, or

simply conversing or asking questions. Writing to the mythic "overseer" is a characteristic of the 5th Dimension, serving a number of purposes. Since the Wolf oversees the functioning of the program, if a computer is broken or a game will not run, it is the Wolf's responsibility to fix the situation. This deflects blame from the site coordinators and the tutors; it also gives a frustrated child a way to vent – and a few minutes to calm down. A letter is written and a new game is selected. Most often, the problem is solved before the next after-school session. Writing to the Wolf also encourages "backdoor" language development – an underlying goal of the program. Children enjoy writing to the Wolf – and really enjoy getting return letters. See Figure 2 for sample letters to and from the Wolf.



Dear Mr Wolf,

We need more 2 player games we got to the expert level on two games I enjoy coming here after school on Tuesday and Thursday It's fun. The Oregon Trail was a little boring but the other games were fun. I wish the Wolf Den was everyday

from, Michael [illegible]

Dear Rosie & Amanda,
I am sorry that I am not able to visit you at the WOLF Den but I am a very busy wolf. I will tell you what I do each day.

8:30 I roll out of my straw bed and brush my pearly white fangs. Then I go to the WOLF Gym for my morning exercises.

10:00 I head to work for the day. First of all, I read the letters that you and your friends from the WOLF Den write to me. That is my favorite part of the day. Then I write back to each of you. My next task of the day is LUNCH!

12:00 LUNCH! I love lunchtime. I usually have sprouts and carrots, and a large bowl of stone soup. And grasshoppers! I love grasshoppers with tree moss and mushrooms! For dessert, I devour a huge, messy mud pie!

1:30 Then comes the duty of fixing the computer problems that you tell me about. This takes up the rest of my day. Sometimes I even have to order new computer games or board games.

I do this all to keep everyone in the WOLF Den happy and I love my job! So, girls, I wish I could visit you but the WOLF has a lot to do to keep the WOLF Den running.

Figure 2: Letters to and from the Wolf

Preparing Tomorrow's Teachers

What are the tutors doing? How does this experience help them learn about technology and push them towards becoming technology-using educators? First, and probably most importantly, they are interacting with the children using technology. Tutors are responsible for organizing activities for their assigned child or children, and they have to be comfortable with the hardware and software. This is no small feat for many of our preservice teachers who still arrive at college with only the most basic experiences involving technology. They can use a word processor and send email, but when faced with installing new software or troubleshooting a printer problem, they blanch. In the WOLF Den they often have to move from computer to computer to find one that will run a finicky computer game. They experience the frustration of computers that will not work; they struggle with software. They learn to deal with that frustration and troubleshoot the problem. More often than not, they get it to work. We think that this is a crucial part of the process of becoming a technology-using educator. The realistic fact is that in most schools there is *not* a computer technician available right when you need help with a piece of software that will not work. Teachers must be comfortable with problems if they are to be successful as they incorporate technology into their classrooms, and we are finding that experience in an informal setting such as the WOLF Den provides opportunities for preservice students to master some of these necessary skills. One tutor struggled with a particular game, and finally turned to the Wolf.

> Today I was not looking forward to going to the tutoring session...This attitude changed, however when R and S arrived. They both seemed excited to be there. This made me look forward to working with them. They also were thrilled because the Wolf had written them back a letter, especially addressed to them. Because R and S have been having computer problems with the Lemming's Paintball, I suggested last week that they write a letter to the Wolf and let it know that there were problems with the game. S wrote the letter notifying the Wolf that that the game would freeze up when they got on an advanced level in the game. R and S were frustrated when once again the computer froze as they progressed through the game. To be honest, I was not surprised that it did because I have a feeling that the lab top causes the problems.

The WOLF Den uses school equipment and a wide variety of educational and edutainment software. The problem of getting software to run on less-than state of the art equipment is one continually faced by teachers.

There are few standards for this software – video requirements, for example are a perennial problem. Novice users are simply stopped dead by a dialogue box stating

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This program requires 256 colors.
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and requiring them to change system settings (and then remember to change them back so that other programs will run correctly). In one interaction, a child was overheard complaining, "I want to play." The tutor replied (with some anxiety), "I am trying to get the game to work…just hold on." Tutors are learning that they not only have to be patient with the computer software, but they must be patient with the children they are working with. Tutors help each other solve problems, engaging in early collegial activity, and learning that, in schools, cooperation is paramount. By the way, children often know how to solve problems, and in settings such as the WOLF Den, the children often teach the college students. That's a learning experience too.

Beyond basic technology-related tasks, tutors have to guide and facilitate interaction between children and computers. For example, in one instance, a tutor and two children were playing *Oregon Trail.* The children were getting too much meat and not enough vegetables (children like to hunt in this program). The tutor attempted to guide them, engaging them in conversation about the need for vegetables to sustain life. She was helping the students with decision-making skills and encouraging them to try different strategies. In fact, she was trying to help them be successful. Tutors help children make decisions, encourage them to try new games, give them positive reinforcement, and intervene during students' conversations when necessary.

Children in the WOLF Den range in age from 7 to 11, and while each room in the maze has activities for children at different ability levels, the range of age and ability levels is an opportunity for preservice teachers to learn how to meet individual needs. One tutor arranged for her two children to use two computers next to each other, while she assisted and played along with each. Such situations mimic what the preservice teachers will face in the classroom, particularly when attempting to teach in new ways: new software, many children, too many questions, impatience with things that don't work *right now.* The support structure of the WOLF Den helps, and preservice teachers are learning to cope, and ultimately to experience success. Tutors also learn that children often know how to do things that they don't. Everyone learns in such an environment.

Over the course of the semester, tutors learn a lot about children. And they learn a lot about the process of learning. It is the serendipitous nature of learning that amazes beginning preservice teachers: you do *not* have to teach everything explicitly. Children will learn when they are in an inviting and challenging environment. When interacting with technology, this can be particularly evident. As one tutor played *Where in the World is Carmen San Diego?* he "saw" a child acquire knowledge as a result of the game. After a couple of rounds, the suspect was again in Zaire, and the child (who had not known where it was earlier in the game) *knew* what the information was referring to and found Zaire immediately on the map. Both child and tutor ended that afternoon with a sense of accomplishment and something learned.

Why will this experience prepare our preservice teachers to use technology? Tutors are using technology in a setting where the focus is fun but learning is occurring. Technology is simply the medium through which tutors interact with children, observe their learning and behaviors, learn to talk with children about problems and problem solving, all while learning to manage the technology itself. They use basic technology skills and develop more advanced ones. They learn persistence and tolerance for ambiguity – one of the known hallmarks of a competent technology user (Harris 1994; Fujieda & Matsurra [no date]; Bailey & Lumley [no date], Dockstader 1999). They begin to see that technology can support teaching and learning.

The tutors start the semester participating in this program because it is a course requirement. Little do they anticipate the powerful effect that they will have on children, nor the effect the relationships they build will have on them. They end the semester humbled about what they have learned – about children, about technology, and about the powerfully difficult profession they have chosen to enter.

> "I was very pleasantly surprised when I was given this opportunity to do this program with this great group of students. I was honestly kind of dreading tutoring a little bit because I felt just sitting down with a student with a book would be so boring and mundane. But this experience has been soooo much better than what I had expected. Not only did I get to have a good time while playing some games, but I also was able to learn how to work with students on a one-to-one basis. Some of the lessons I have learned in this tutoring experience will benefit me for years to come."

Meeting Standards

We are cognizant of the need to provide opportunities for our preservice teachers to develop knowledge and dispositions and to have opportunities to practice behaviors that will allow them to demonstrate that they meet standards for new teachers. We explicit attempt to build those opportunities into our field experiences, connecting preservice teachers with children, environments and experiences where they can begin to master the ISTE Technology Standards for Teachers (NETS·T). SBU also requires that preservice teachers demonstrate mastery of the INTASC (Interstate New Teacher Assessment and Support Consortium) standards for new teachers.

We are in the early stages of aligning our program – courses and field experiences -- with both INTASC and NETS·T standards. Table 1 presents a representative sample of how we see the WOLF Den experiences lining up with NETS·T. (Alignment with INTASC standards is still at a very early stage.) The important aspect of this is that the performances required of the preservice teachers in the WOLF Den are real. They are learning about and using technology not to demonstrate competence in a college course, but to provide children with rewarding, challenging experiences. The children's attendance is voluntary – and there is almost always perfect attendance. That speaks to the tutors' competence.

We are also beginning to examine how participation in the WOLF Den helps children meets the NETS·S (National Educational Technology Standards for Students). Early indications are that children benefit at least as much as the tutors, if not more.

We are extremely encouraged by observations of what tutors are learning. Specifically, it is interesting to note that many of their reflections indicate beginning mastery of knowledge, disposition, and performance indicators for the NETS·T and INTASC standards. One tutor stated, "I have learned the importance of being patient... I have realized not to give them the answers, but challenge them to find the answers. I have learned how much they enjoy the time you spend listening to them." Another tutor's response reflects his ideas of becoming a teacher, "I have learned a lot about what is expected of me as a teacher. I also learned a lot about classroom management and also discipline. I realize the amount of effort and ability that is needed to be a teacher. I have learned I need to continue to learn techniques and teaching strategies."

Finally, in reflecting on his experience in the WOLF Den, one tutor wrote, "I learned that technology is going to be very important in the future of teaching. I feel comfortable using technical equipment and part of the reason why is because of this program."

Experiences that Preservice Teachers Have in the Wolf Den	**Relationship to ISTE NETS.T National Educational Technology Standards for Teachers**
They learn to: use a digital camera use a video camera set up laptops and connect peripherals set up hardware install software troubleshoot systems *use a variety of computer programs* *All of this must be done in a setting where children are depending on the tutors. This is performance assessment at its best.*	I. Technology Operations and Concepts. *Teachers demonstrate a sound understanding of technology operations and concepts.*
They help children select software or other technology-related activities. They plan how best to accomplish the objectives set forth in the activity cards and keep track (in child's log) of what has been accomplished. They make decisions about how to accomplish goals when software, hardware or other materials are not available or working. While playing games, they guide children's activity and keep them on task: *While one tutor and two children were playing Oregon Trail, the tutor tried to help the children because they were getting too much meat and not enough vegetables...the tutor guided them along with the game ...as well as keeping them on task. She was helping the students with decision-making skills and encouraged them to try different strategies.*	II. Planning and Designing Learning Environments and Experiences: *Teachers plan and design effective learning environments and experiences supported by technology.* Teachers identify, select, and use hardware and software technology resources specially designed for use by PK-12 students to meet specific teaching and learning objectives.

One tutor allows her students to use two computers next to each other to accommodate each student's individual needs. Tutors help children learn to alternate who chooses the game that will be played each day to encourage the students to cooperate.	IV. Assessment and Evaluation: *Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies.* *Teachers identify specific technology applications and resources that maximize student learning, address learner needs, and affirm diversity.*
They reflect on their experiences following each session of the Wolf Den. They must discuss interactions with children and use of technology. Journals are sent via email to course instructors. They contribute to and participate in online discussions about the experiences. Preservice teachers learn to use equipment to keep track of their experiences (digital camera, video, etc.) They help each other when they are learning new games or if they are having a difficult time running a new program.	V. Productivity and Professional Practice. *Teachers use technology to enhance their productivity and professional practice.*
Several of the participating children have special learning needs. Tutors experiment with making accommodations to the program structure to help those children be successful.	VI. Social, Ethical, Legal, and Human Issues: *Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply understanding in practice.*

Table 1: Experiences in the Wolf Den Aligned with NETS·T Standards

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Online Discussion as Catalyst for Metacognition by Students and Professors

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Abstract: This session will discuss a variety of online discussion "settings" and present preliminary analyses of discussions in terms of what they tell us about student thinking and professors' responses. We will discuss how the use of online discussion can influence what and how we teach, and how that, in the long run, can affect preservice teachers' development.

Introduction

With the advent of readily available Internet access, online discussions (particularly in the form of live chats) are commonplace for some students. However, for many students, venturing online to discuss course-related issues and content is a completely new experience. Research on the use of online discussion has focused on the effects of online discussions, and the need to develop community in the absence of face-to-face interaction (Ahern 2000; Klemm 1998; Charp 1998) and how to keep discussions going and focused (Ahern 2000; Wolfe 2000). Others have examined how best to prompt and moderate discussions (Scarce 1997; Johnson 1999).

If, as we believe, *teachers teach as they were taught*, and if current preservice teachers have not been taught using technology (which still remains the case), then it is our responsibility to help remediate that situation. We posit that a variety of sustained, positive experiences involving technology in teaching and learning environments during preservice teachers' undergraduate courses will help them see the value of using technology in the classroom. One way that we are doing this is through the use of online discussions to supplement and extend in-class discussions. We are interested in the question of what we can learn about students' thinking as a result of analysis of discussions. We are also analyzing how the use of online discussions affects teaching.

This paper presents a variety of online discussion "models" in terms of what they tell us about student thinking and professors' responses. We will discuss how the use of online discussion can influence what and how we teach, and how that, in the long run, can affect preservice teachers' development.

Implementing Online Discussions: Why and How?

Over the past several semesters, several of us have examined our courses and questioned how technology could be used to support and improve learning, we decided that we would incorporate online discussions in an effort to (1) increase the quality and quantity of student "talk" about course content and related issues, (2) encourage metacognitive reflection about course content, and (3) improve teacher/student communications. Working together and separately, we set up a variety of discussions to meet the needs of several different course structures. We have used several different models and at least two different technology-support structures.

Models for Online Discussions

One approach is to set up a *teacher-led discussion.* Using this model, the professor seeds the discussion on a regular basis; requires students to respond, and encourages them to interact with each other. The advantage of this model is that all students must respond to selected prompts. It can extend or supplement in-class discussion. Because the instructor leads the discussion, students approach the discussion as an obligation or course requirement and their participation has an obligatory tone. This approach is being implemented in one setting where students from a number of sections of the same field-based education course are assigned to small group discussions led by the faculty. The idea is to have students interact around course issues, and to share perspectives gained from different field sites.

Student-led discussions turn the tables, and put the onus on students to start and keep the discussion going. This approach has merits because it requires students to take some ownership of the course material. Each week one or more students are assigned to lead the discussion. This approach is being implemented in an introductory U.S. History course, where the professor hoped to change the classroom dynamic by forcing students to take some responsibility for intellectual leadership in the course.

Open-forum discussions are arguably the most effective if they work, and most closely mimic good face-to-face discussions. This approach is being implemented to connect two groups of preservice students working in two Professional Development Schools. These started as teacher-led discussions, but quickly took on a life of their own as the preservice teachers used the discussions to support their fieldwork experiences. The students want and like professors to engage in the discussions, but this group, at least, exemplifies the real purpose of online discussions.

Observations and Responses

In classroom-based discussion, professors can model higher order thinking, and even when discussions are student-led, professors can mediate the process. As we "listen" to the online discussions (and participate in them), we are struck by the need to help students learn how to ask appropriate questions in order to stimulate discussion. We are aware that students tend to focus on questions at the lower levels of Bloom's taxonomy, and we have learned that we need to model better questioning. On the history discussion, we have found that students who do ask better questions tend to ask counterfactual or "what if" questions.

Using discussions has forced us to think about our teaching in ways that are, ultimately, refreshing. We are forced to think about how we teach, particularly the need to teach *thinking* –disciplinary thinking, certainly, but also general higher order thinking skills. We are finding that online discussions provide opportunities for professors to analyze students' work from a very different perspective.

Student reactions to the discussions vary greatly. Some tend to like the safety of the forum, other find the technology problems overwhelming. Some remain bewildered about the technology, but have taught us that faulty design (even that of the default discussion web in FrontPage) makes a great difference in student's use of a site.

We have found (not surprisingly) that students who do not read textbooks also do not tend to read web sites; and many of those who refuse to participate in class do are not clamoring to be heard online. However, aggressive students cannot dominate in an online environment as they can in face-to-face discussions; quiet students with opinions have equal voice. Moreover, many students acknowledge that they like the opportunity to hear what others have to say. This is particularly true in discussions involving students from more than one class.

Overriding Issues: Usability, Access and Stability

We have been using discussions for several semesters, and each semester new challenges arise. While confident in our abilities to guide discussions and manage the intellectual aspect of the discussions, problems with technology have often proven to be intractable. One semester we used a discussion set up as a newsgroup. Even though more difficult to set up and maintain, it had the advantage that users could attach documents to their comments. We are currently using *FrontPage* to create and manage discussion webs. They are far easier to set up and maintain, but do not allow users to attach files. Every decision is a trade-off.

The major issue on our campus is Internet access. When the Internet is down, students *cannot* participate. When traffic is so high that access is unbearably slow, they *will not* participate. There have been persistent Internet outages and periods of extreme slowness (for reasonably long times this semester). This has affected both professors and students. For those who are novice users of this type of technology, it has had a definite negative impact. Seasoned users are more tolerant. However, professors can bear only so much disruption of a course; students are not persistent or tolerant. If it doesn't work after a few tries, they give up. End of discussion.

The final word: the technology must support learning, not get in the way.

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Project Learning Links:
A Model for Integrating Technology into Teacher Education

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Abstract: *Learning Links* is a PT^3 project housed at the University of Nevada, Reno. The project uses a four-component model to infuse technology in all aspects of the undergraduate teacher education program: (1) modeling, (2) integrating, (3) enhancing, and (4) applying. University faculty are given technological assistance and incentives to develop the skills and uses for technology within their existing education courses. Data describing the current level of technology use by the faculty, as well as their attitudes toward technology, are shared and the implications for infusing technology in teacher education are discussed.

Introduction

Nevada is not unlike many states when it comes to infusion of technology into the teaching and learning environment of the public schools. Through legislate initiatives and local incentives, strides have been made to improve technology access in classrooms across the state. This initial investment has gone into hardware, software and connectivity in the schools. By the beginning of the 1999-2000 school year, every classroom in the state reportedly had at least one computer connected to the Internet. Many classrooms have more than one computer and many schools have fully equipped computer labs with Internet connections.

What remains a major gap in improving Nevada public schools through technology infusion is the lack of skills and knowledge on the part of teachers to make full use of the technology they find in their schools. According to Mark Knudson, educational technology specialist at the Nevada Department of Education, only an estimated 5% of teachers are at the point of technology infusion in the curriculum. As is commonly the case, the largest gaps and the greatest weaknesses in technology infusion exist in the most rural and low-income pockets of the state

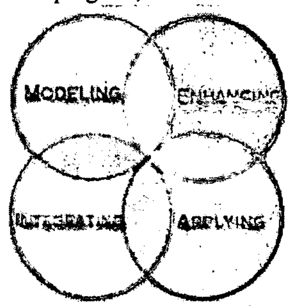
However it is not only in the K-12 system that gaps exist in the infusion of technology in teaching and learning. Similar gaps and weaknesses could be found in the teacher preparation program at the University of Nevada, Reno (UNR), one of only two four-year institutions of higher education in Nevada. The university has programs leading to teacher licensure in the areas of elementary education (grades K-8), secondary education (grades 7-12), and special education. While prospective teachers in each area acquire some technology skills through one required course in technology, few exit the program with the skills, knowledge, and understanding to truly infuse technology into their classrooms.

Like the public school system, a substantial investment has been made to equip university classrooms and labs with state-of-the-art technology. Some faculty have made good use of this technology, but many are still using traditional teaching methodologies to present their course content. Until very recently, the technical support and incentives to enable faculty to redesign their courses using teaching and learning technology have not been readily available.

In the spring of 2000, faculty from the UNR College of Education developed *Project Learning Links* in an attempt to address perceived weaknesses in the infusion of technology into the teacher education curriculum. *Learning Links* is a three-year federally funded PT^3 grant. This paper describes the model used by the project. In addition, university faculty attitudes and expertise in using technology were assessed prior to the onset of project activities. Trends discovered relative to these attitudes and skills are discussed, as are the implications these findings have for the necessary activities of *Learning Links*.

The Learning Links Model

In order to efficiently use learning technology in school classrooms, teachers must think differently about the teaching and learning process, classroom organization, methods of content delivery, and the nature of student projects and assignments. To accomplish this, *Learning Links* makes use of four change components in the UNR teacher preparation program, illustrated in the graphic below.



These four components comprise system-wide changes in the way classes are taught, skills are demonstrated, and performance is assessed. The revision of the UNR Teacher Preparation Program will be a systematic process over the three-year period of *Project Learning Links.*

Modeling

This component of *Learning Links* is an important part of enabling future teachers to understand and appreciate the use of technology in teaching and learning, where learning technology is used both by the instructor and the students. To achieve this change component, university faculty are given opportunities to grow in knowledge and skill in the use of effective teaching and learning technologies. *Learning Links* offers incentives, through a *Faculty Fellows* program, for professors to effectively adapt their courses to model the use of teaching and learning technology.

Faculty in the College of Education apply for the Faculty Fellows program each semester. Applications describe the changes the faculty member proposes to make in a specific course by the infusion of learning technology. Making changes in the way they *model* the use of technology is classified as a Level I application. In the application they specify: (a) what technology will be used; (b) how delivery of course content will be modified; (c) how assignments and projects will use technology; and (d) how the infusion of technology into teaching and learning will be modeled.

From among the applicants, the dean of the college selects five faculty members each semester to participate in a Faculty Learning Fellows program. As Fellows, faculty members are able to get a course release; receive targeted hardware and software upgrades that relate directly to their course modifications; and receive extensive technical support from the *Learning Links* project staff.

Integrating

While it is important for pre-service teacher education students to have learning technology modeled by professors, it is equally important for them to devote part of their learning experience to understanding principles and concepts relating to integrating learning technology into the K-12 curriculum. The change component, *integrating,* emphasizes adapting the curriculum of key education courses. The focus is on providing prospective teachers with the skills and strategies that they will need to modify, organize, and execute technology-rich curricula in their classrooms as they take their places in Nevada's K-12 schools.

The actual changes to the content of key pedagogy or methods courses is accomplished through the *Faculty Fellows* program. Applications from faculty may be designed as Level II, indicating that their course would explicitly teach *integrating* technology into teaching practices. Incentives allow instructors to reconstruct their course content and assignments to incorporate more of an emphasis on methods of technology infusion. Examples of activities incorporated into reconstructed courses could include the following: (1) having students develop and present demonstration lessons that incorporate technology infusion; (2) discussing and demonstrating classroom management differences between a traditional and a technology rich classroom setting; and (3) demonstrating ways to incorporate learning technology into

inquiry and problem solving instructional approaches. Learning Links also involves a cadre of Master Teachers nominated by school district superintendents throughout the state for their use of technology in teaching and learning. These teachers give lectures, demonstrations, and conduct discussions within pre-service teacher training courses about their use of technology in the classroom.

Enhancing

The intent of this change component is to move all pre-service teacher education students beyond the basic skills level in using learning technology to a level where they can function more independently in installing, maintaining, trouble-shooting, repairing, and managing classroom, computers, computer labs, and small computer networks. In most schools, teachers have district technology support. However, such support is often spread thin, and in some very rural areas, technology support is almost nonexistent. The so-called digital divide also plays a role in the degree to which technical support is available to teachers. Richer districts and richer schools are often able to find resources to maintain, repair, and manage computers and networks; whereas, in poorer areas, such resources are scarce. The teachers leaving the UNR program should be able to go beyond a "plug-and-play" level of computer expertise. The goal is to have them be as self-sufficient as possible, so that when they are in a school with little or no technology support, they can keep things going and provide stability for other teachers in their schools.

Training for future teachers in this component is accomplished by the re-design of the traditional three-credit course in the use of technology. This course was previously composed of modules presented in a self-paced format. Those modules have been condensed and redesigned, and additional modules were developed. These new modules cover topics such as trouble-shooting, making minor repairs, and management of simple computer telecommunications networks. Delivery of these additional modules of instruction is accomplished through involvement with the lab facilities at Truckee Meadows Community College, a nearby state institution.

Applying

This change component emphasizes field based and on-line experiences between future teachers and students in Nevada's schools. These experiences give prospective teachers practice in using technology effectively with children. One type of experience occurs in practicum courses where future teachers participate in technology rich classrooms in nearby schools. A second type of experience includes interacting with children from rural/remote areas using the *Nevada Bell Student-to-Student Network*. Nevada Bell, the state telephone service provider, has provided dedicated hardware to establish connections by which future teachers may correspond with, provide tutorial assistance for, and share resources with children in rural schools. This gives teachers and students experience with synchronous and asynchronous teaching methods. Video conferencing, chat rooms, bulletin boards, and E-mail also can be used.

Faculty Attitudes and Expertise in Technology Use

Prior to beginning project activities in the fall of 2000, all faculty in the College of Education were asked to respond to a written survey about their use, level of expertise, and attitudes toward technology. The survey was designed to assess the areas of "personal productivity," as well as "modeling", "integrating," and "applying" technology as described in the model above. "Personal productivity" related to faculty skills and uses of technology in their own scholarship, lesson planning, student assessment, and similar activities. The survey used a four-point, Likert-like scale in which the faculty indicated their rating of their skill from (1) "I do not use this technology" to (4) "I use this technology extensively." In addition, faculty were able to check a box indicating, "I would like to learn more about this technology." Attitudes were assessed in a section of the survey in which faculty rated statements about the use of technology from (1) "strongly disagree" to (4) "strongly agree."

Thirty-seven (37) out of 49 teaching faculty in the college completed the survey (75%). Table 1 reports the mean ratings of faculty in their use of technology.

Technology Application	Professional Productivity	Modeling in Classes	Integrating in Curriculum	Applying in Field Experiences

Word processing (Word, WordPerfect, etc.)	4.0	2.44	3.56	1.88
Database (Access, FileMaker, etc.)	2.03	1.34	1.34	1.38
Spreadsheet (Excel, Lotus, etc.)	2.66	1.56	1.44	1.31
Statistical packages (SAS, SPSS, JMP, etc.)	2.34	1.53	1.59	1.34
Internet browsers (Netscape or Explorer)	3.75	2.53	3.19	1.81
Web-page development/personal Web-page	2.16	1.47	1.69	1.34
E-mail	3.75	2.50	3.28	1.87
Scanning and digital camera applications	2.25	1.25	1.22	1.25
Digital image creation and editing	1.47	1.13	1.16	1.19
Audio and video editing	1.28	1.19	1.22	1.16
Research/searching for resources (search engines/electronic databases)	3.34	2.28	2.84	1.18
Presentation software (PowerPoint, Corel, etc.)	2.44	2.28	2.47	1.72
Technology resources in lesson design/related to your discipline	Not asked	2.06	2.28	Not asked
Student assessment	Not asked	1.94	Not asked	Not asked
Course delivery software (WebCT, etc.)	Not asked	1.59	Not asked	Not asked
Electronic discussion groups	Not asked	Not asked	2.03	Not asked
Desktop publishing	Not asked	Not asked	Not asked	1.38

Table 1: Mean response of faculty indicating their level of use of technology in various contexts (1= no use of this technology; 4 = extensive use of this technology)

Overall analysis of the results indicated that faculty rated themselves as using technology more in their personal productivity than in other areas. All faculty responding indicated extensive use of word-processing, e-mail, and Internet browsers. Of those responding, 41% indicated an interest in learning more about Web-page development and about scanning/digital camera applications. There was also interest in learning about audio and video editing (30%). Faculty also indicated that they modeled and integrated technology in their courses and course assignments. The most common applications used in this manner were word processing, e-mail, and Internet exploration, followed by the use of presentation software.

The lowest technology use came in application to field experiences and practica in the public schools. Few faculty used any form of technology in this context. In addition, as reflected in Table 2, few faculty felt that the explicit infusion of technology in these experiences was needed. This is in contrast to the relatively strong acceptance of technology in the areas of personal productivity, modeling, and integrating into the teacher education curriculum.

Attitude Statement	**Mean**
• Technology is valuable in my professional productivity	3.72
• It is important for me to learn to use new technology	3.78
• I am comfortable using technology	3.34
• The present trend toward integrating technology into teaching and learning is necessary	3.59
• It is important for me to model technology in my courses	3.44
• Modeling the use of technology in my courses is important in the development of future	3.38

educators	
▪ I am comfortable modeling technology in my courses	3.03
▪ It is important for me to integrate technology in my courses	3.34
▪ Integrating technology into pre-service education courses is important in the development of future educators	3.19
▪ There are sound educational reasons for integrating technology into my teaching curriculum	3.44
▪ Technology can improve classroom learning	3.41
▪ It is important for me to use technology in field-based experiences	2.65
▪ Using technology in field-based pre-service education courses is important for the development of future educators	2.68

Table 2: Mean attitudes of faculty related to use of technology in teacher education (1= strongly disagree; 4 = strongly agree)

Discussion

The majority of university faculty at this institution have embraced the use of technology to enhance their professional productivity. They have been somewhat slower to infuse technology in their preparation of preservice teachers. The faculty at the University of Nevada, Reno, vary in their attitudes about the importance of technology in teacher education. The value of infusing technology into practicum or field experiences in public schools has yet to be widely recognized. This implies an assumption by faculty that campus-based experiences with technology are sufficient for preservice teachers to be able to infuse technology in their own teaching after graduation.

The results of the survey instrument indicate a willingness on the part of faculty to receive information, support, and tools to make effective use of technology in many aspects of teacher education. However, leadership will be needed in order to influence faculty attitudes about the importance of incorporating technology into the preservice teachers' real work with children in school settings.

Although not reflected in the survey, anecdotal comments by faculty may indicate another impediment to the infusion of technology in the teacher education curriculum. Similar to conditions at many other state-supported universities, this faculty has often been asked to accomplish more with fewer resources. Requirements for in-depth performance assessment of students, increased standards for publication and scholarship, and emphasis on teaching effectiveness have not been accompanied by additional faculty, support staff, or material resources. There is hesitation and skepticism about new initiatives. However, there is some enthusiasm about *Learning Links.* This is largely because the project provides three very important and rare commodities: time (through release from teaching one course); support (through the technical assistance of *Learning Links* staff); and resources (by providing targeted software and equipment). It will be interesting to see how faculty skills, use, and attitudes toward technology are influenced by the three-year implementation of *Project Learning Links*.

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The Effects of Web Pages Design Instruction on Computer Self-Efficacy of Preservice Teachers

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Abstract: This study tested the effects of web pages design instruction on improving computer self-efficacy of preservice teachers. A sample of 206 preservice teachers participated in this research. A pretest-posttest design, including a 14-week instruction of web pages design, was conducted. The instruction of web pages design did significantly improve the computer self-efficacy of preservice teachers. Various computer experiences, including weekly computer use, weekly internet use, the use rates of word processing, e-mail, game, presentation software, were significantly related to computer self-efficacy. The use rates of word processing software and computer graph, weekly computer use, and age were the significant predictors of computer self-efficacy. The preservice teachers owning higher perception of computer self-efficacy revealed more confidence on web authoring software self-efficacy. Generally, it is confirmed that most educators' belief to increase the opportunities to learn and use computer may facilitate the confidence and competence of preservice teachers.

Instruction of web pages design has become popular in the courses of preservice teacher preparation due to the establishment of computer network infrastructure and the prevalent www application. However, the learning doesn't guarantee the owning of confidence or efficacy in implementation. According to the report from Milken Exchange on Education Technology and International Society for Technology in Education (1999), the technology related course in preservice teacher preparation did not increase the use of the future teachers in computer application in instruction. There were various issues surrounding that phenomenon including shortage of enough facilities and infrastructure, the inappropriate pace of courses agenda, and lack of the personal confidence and capability of some teachers. The current study aims to explore the last issue mentioned above. Focusing on computer self-efficacy that related to personal belief and perception of capability, this study tested the effects of web pages design instruction on improving computer self-efficacy of preservice teachers in addition to the analysis of correlated factors.

Conceptual Framework

Teachers' self-efficacy has always been a significant concern in teacher education. Research (Bandura, 1997) has verified teachers' self-efficacy would affect their instructional performance and then influence the students' learning outcome. Referring to the increasing application of information technology in education, computer self-efficacy of preservice teacher may affect their future instructional arrangement regarding information technology application. The concept of computer self-efficacy and correlates, therefore, deserve deep exploration.

Derived from Bandura's social cognitive theory (1986), self-efficacy was introduced to computer use and a variety of computer behaviors in late 1980's (Hill, Smith, & Mann, 1987; Gist, Schwoerer, & Rosen, 1989; Murphy, Coover, & Owen, 1989). Most of the early research focused on the identification and measurement of computer self-efficacy. Based on the original concept, computer self-efficacy refers to a judgement of one's capability to use a computer (Compeau and Higgins, 1995, p.192). Compeau and Higgins (1995) defined the dimensions of computer self-efficacy, include magnitude, strength, and generalizability.

However, Marakas, Yi, and Johnson(1998) divided computer self-efficacy into task-specific computer

self-efficacy and general computer self-efficacy. Task-specific computer self-efficacy refers to an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing (p. 128). Conversely, general computer self-efficacy refers to an individual's judgement of efficacy across multiple computer application domain (p.129). And they argue the general computer self-efficacy as a collection of task-specific computer self-efficacy and enactive experiences. A task-specific computer self-efficacy perception is associated with a specific task performance.

According to the literature, the interest in research with regard to the construct of computer self-efficacy has been to understand the mechanisms affecting individual computer behavior or the effect of training related to computer application. At one hand, various research have developed different instruments of measuring computer self-efficacy. On the other hand, the results of empirical research concerning the correlates of computer self-efficacy were equivocal. In terms of computer self-efficacy measurement, most of them are Likert type scale with point range from 3 to 7. Fewer of them use the approach suggested by Bandura (1986) that requires the individual to response dichotomously the questions. Although the computer self-efficacy measurements were almost unidimensional in nature, the strength (confidence), the credibility of the instruments was presented is use (Marakas et al., 1998).

As for the antecedent, consequent, and moderating factors related to computer self-efficacy, Marakas, Yi, and Johnson (1998) have done a thorough review. In the comprehensive analysis about the identified 40 papers, they grouped the various factors and discussed the issues of requiring further exploration. But, none of the cited paper used the preservice teachers as sample. The tasks involved in those studies were few related to the network that prevails in the new era. In the following sections, research factors used in this study will be reviewed.

Computer Self-Efficacy and Web Authoring Software Self-Efficacy

As mentioned above, Marakas, Yi, and Johnson(1998) divided computer self-efficacy into task-specific computer self-efficacy and general computer self-efficacy. They explained general computer self-efficacy is a product of a lifetime of related experiences and closely conform to the definition of computer self-efficacy that is often used in the Information Systems literature, while task-specific computer self-efficacy is associated with a specific task performance. The author accepts the notion of Marakas et al. in this current study. However, the term of computer self-efficacy is still used to indicate the general computer self-efficacy thought as a collection of all computer self-efficacy perception accumulated over time. Further, the term of web authoring software self-efficacy is adopted to refer to the task-specific computer self-efficacy because it more obviously presents the task in this study.

Computer Experiences

Experience is an important factor that affects human learning. Resulted from the interaction between environment and human being, experiences could enforce or decrease our learning. In the past empirical research regarding computer use, computer experience has been the important variable included in studies. In terms to computer self-efficacy, many studies also proved the significant effect of computer experiences (Busch, 1995; Henry & Stone, 1995). Due to the rapid development of information technology, the scopes of hardware, software, and application are quite various. The content of computer experiences needs to be defined more clearly. It could indicate the use period or familiarity degree of specific software, system, or frequency of use. The finding resulted from clear definition of studies would give more value of application. An example as the study of Ertmer, Evenbeck, Cennamo, & Lehman (1994), two kinds of computer experiences, e-mail and word processing, were compared in contrast with computer self- efficacy. They found experience on one system tends to increase computer self-efficacy on other related systems.

Computer Network Anxiety

An extensive amount of research has been done to explore the source and nature of anxieties about the computer-related technology. Generally, computer anxiety indicates the negative attitude toward

computer use or the feelings of fear, stress, and worries about interaction with computer. There exists a reciprocal relationship between computer anxiety and computer self-efficacy. That means people with higher computer self-efficacy may experience fewer computer anxiety, while individuals with high computer anxiety could present lower computer self-efficacy and performance in dealing with computer affairs. Empirical studies strongly support for the negative relationship between computer anxiety and computer self-efficacy (Martocchio, 1994; Henderson, Deane, & Ward, 1995). Therefore, George and Camarata (1996) suggested that the increase of the instructor's self-efficacy in use of technology as the pivotal mechanism can eliminate the level of anxiety and then accept the technological change. In this research, computer network related conception was emphasized and added in the measurement.

Web Pages Design

Web pages design involves in a skill set of multiple applications, including text processing, graphic arrangement, and links planning. Due to the web-based instruction getting popular, the teachers have to learn how to post the instructional materials and related information on web site. There are many kinds of HTML web authoring tools available in the market. Some of them are included in the most popular word processing or desktop publishing software packages. The development and trend of context make it desirable and feasible for teachers to learn the simple design and editing of web pages.

Research Questions

Surrounding the computer self-efficacy of preservice teachers, this study attempts to answer the following questions:

1. What are the relationships between computer self-efficacy of preservice teachers and their background variables and computer experiences before instruction?
2. What are the predictors of computer self-efficacy of preservice teachers?
3. Does the web pages design instruction improve computer self-efficacy of preservice teachers?
4. What are the relationships among computer self-efficacy, computer network anxiety, and web authoring software self-efficacy after instruction?
5. Can computer self-efficacy of preservice teachers affect web authoring software self-efficacy?

Method

Sample

In the spring semester of 2000, 206 preservice teachers who registered in five sections of a course related to computer network application in instruction, two hours each section every week, participated in this research. The usable number of sample is 203. The male preservice teachers were 60%, while the female preservice teachers were 40%. The range of age was divided from 25 and under (17.2%), 26-30 (54.3%), 31-35 (21.7%), to 36 and upper (6.4%).

Instruments

The instruments were drawn from previous research and revised. The computer self-efficacy scale consisted of 10 revised the statements that came from the scale of Compeau and Higgins (1995). The 10-item computer network anxiety scale referred many previous computer anxiety scales and added in the conception of network. The statements describe the conditions that may cause anxiety, for example, "use computer network to transfer data to friends". Both the computer self-efficacy scale and the computer network anxiety scale are 5-point Likert type scales.

The web authoring software self-efficacy scale was developed based on the contents of instructional requirement. Ten items are comprised in the measure involving to the various functions of the selected web pages authoring tool and the required integration from the instructor. The subjects were asked to point out

the degree of difficulty in the range of 1 to 5.

The reliabilities for computer self-efficacy scale, computer network anxiety scale, and web authoring software self-efficacy scale were alpha = .79, 87, 89, respectively.

The data regarding computer experiences were collected in two parts. The first part included the hours spent in using computers and internet weekly. The second part was 5-point Likert items to ask the subjects to point out the rate of use in specific software activities.

Procedures

Background information, prior computer experiences, computer self-efficacy measure were included in a questionnaire which was completed by each preservice teacher in the first class section. Then a 14-week instruction of web pages design proceeded. Only difference in sections, the same instructor using the identical web authoring software and materials in the same computer lab at the identical pace taught all participants. Computer self-efficacy scale, computer network anxiety scale, and web authoring software self-efficacy measure were processed again at the end.

Design and Data Analysis

A pretest-posttest design was the basic research design. Pearson correlation coefficients were computed for background variables, various computer experiences, and the mean of computer self-efficacy scale in the questionnaires before instruction. To get the answer if the web page instruction improves the computer self-efficacy of preservice teachers, paired *t*-tests were conducted to compare the change between pre-post scores of computer self-efficacy scale. Regression analysis was performed to find the predictors of computer self-efficacy. ANOVA was also conducted to investigate if different levels of subjects in computer self-efficacy measure before the web pages instruction would show significant differences on web authoring software self-efficacy after a semester instruction.

Results

To answer the research questions, statistical results are reported as follows:

Research Question 1:

First, the relationships among background variables and computer self-efficacy before instruction were examined. Background variables included in the correlation analysis with computer self-efficacy were gender, age, computer access, weekly computer use, and weekly internet use. The gender variable showed no significant relationship with computer self-efficacy measure, whereas age appeared significantly negative relationship with computer self-efficacy. Computer access, weekly computer use, and weekly internet use were significantly correlated ($p < .05$) with computer self-efficacy measure.

Relationships among various software use rates and computer self-efficacy were then computed. Significant relationships were found among all of the various software use rates, which include word processing, spreadsheet, presentation, e-mail, computer game, computer graph, and computer self-efficacy, with the exception of the use rate of BBS.

Research Question 2:

Stepwise multiple regression was examined for computer self-efficacy measure before instruction using the significant correlates showed above in background variables and various software use rate. The results represent the impact of ten hypothesized causal variables on computer self-efficacy. According to the results of statistical analysis, the use ratsse of word processing software, weekly computer use,

computer graph software use rate, and age were the significant predictors of computer self-efficacy.

Research Question 3:

The comparison of computer self-efficacy measure before and after instruction was conducted to answer this question. The paired *t*-tests indicated that there was a significant difference between the means ($t = -6.679$, $p < .001$). The posttest score (Mean = 38.54, SD = 5.42) was significantly higher than the pretest score (Mean = 35.78, SD = 4.91). Apparently, the instruction of web pages design did significantly improve the computer self-efficacy of preservice teachers.

Research Question 4:

Significant relationships among computer self-efficacy, compute network anxiety, and web authoring software self-efficacy after Instruction were found. The posttest score of computer self-efficacy was reported significantly negative correlation with computer network anxiety score, while positively correlated with the measure of web authoring software self-efficacy.

Research Question 5:

ANOVA was conducted to answer this question. While the subjects were divided into three levels (low, middle, high) based on the score of computer self-efficacy measure before the web pages design instruction, significant difference was found among groups on web authoring software self-efficacy after instruction. A post-hoc analysis using the Scheffe test indicated that the web authoring software self-efficacy (39.64) of the high group was significantly higher than those (36.36) of the middle group.

Discussion

The purpose of this study was to explore the computer self-efficacy of preservice teachers, find out the correlated factors, and test the effects of web pages design instruction on improving computer self-efficacy. From the results, as many previous research findings, age and computer experiences are two important factors in computer self-efficacy. The most notable findings of this study were the indication of computer experiences content. Various software experiences provided more meaning than spending time in terms of computer application research. The frequency of word processing and weekly computer use as the predictors of computer self-efficacy is congruent with the recognition of the experienced trainer. The significant relationships among various software use rates and computer self-efficacy in addition to the effect of web pages design instruction on improving computer self-efficacy confirmed the importance of accumulation of computer experiences. The result is consistent with the finding of Ropp's study (1999) that used the preservice teachers as subjects. One unexpected finding was the use rate of computer graph as the significant predictor of computer self-efficacy. Further research is needed to explain the reason.

The other important result is, based on the conception of Marakas, Yi, and Johnson (1998) who divided computer self-efficacy into task-specific computer self-efficacy and general computer self-efficacy, that general computer self-efficacy indeed enhanced after experiencing more computer learning and using. In terms of specific task related computer self-efficacy, the web authoring software self-efficacy in this study, it showed the effect of general computer self-efficacy. The preservice teachers owning higher perception of computer self-efficacy revealed more confidence on web authoring software self-efficacy. This result proved the finding of the prior research (Ertmer, Evenbeck, Cennamo, & Lehman, 1994) that experience on one system tends to increase computer self-efficacy on other related systems. The result of computer network anxiety negatively related to computer self-efficacy and web authoring software self-efficacy is also consistent with most previous empirical studies.

Generally, this study supports almost all of previous research even with different kind of subjects. It also confirmed most educators' belief that increasing the opportunities to learn and use computer may facilitate the confidence and competence of preservice teachers.

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Change as the Constant in Creating Technology Rich Learning Environments

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As members of the implementation team for the Preparing Tomorrow's Teachers to Use Technology (PT3), we regularly participate in meetings focused on strategies for intensifying and broadening the use of technology rich practices in teacher preparation. Essential to our successful experiences with technology and innovative teacher preparation has been our willingness to participate in ongoing change. This change is multidimensional as it relates to the nature of our classroom, course content, and technological strategies used to accomplish our goals for student learning. If we have come to know anything as a result of our participation with technology integration it is that change is the constant.

Our PT3 grant is based upon the premise that if preservice teachers learn course content in technology rich classrooms, they will be more likely to use technology when they teach in their own classrooms. Those of us passionate about technology integration have sought ways to go beyond the boundaries of the 'classroom' and 'packaged' course content, and a 'particular' set of teaching strategies to an expanded interpretation of the dynamics of the learning environment. We are willing to share our interpretations of the dynamics and processes inherent to the nature of innovative practice. However, the strength of our offerings lie within your interpretation of how you can best generate learning experiences that will be most useful to your own context.

Each semester begins with change and uncertainty as we recognize how the individuality of our learners, uniqueness of our own identities, advancement of knowledge in our chosen fields, and onset of the latest technologies demand new ways of knowing within our learning environments. Freedom and choice are key to promoting exceptional learning opportunities. However, as students exercise their right to choose and their freedom to design more uncertainty emerges. Becoming comfortable with the resulting change and uncertainty stemming from these freedoms and choices takes time for the teacher and the students.

To create a teaching and learning environment that provides students the power to choose, the ability to exercise the freedom to explore knowledge relevant to their lives as future teachers has challenged us. We have critically examined what was needed to transform the traditional college classroom into a learning environment conducive to preparing teachers of future generations without compromising the rigor of a quality education. We called into question the way in which course content was structured, the nature of instructional strategies used to deliver the course material, ways in which we used in/out of class time, and the degree to which our learning experiences truly motivated our preservice teachers to want to learn. The following questions guided us on our journey of change and innovation.

Can course content be predetermined and fixed? We have found that to rely on the most recent edition of a single textbook by a prominent author or a selected list of readings is inadequate. Instead we identify lists of resources and place our students in the role of selecting what is most relevant for constructing knowledge to facilitate a quality learning experience. So by giving students the freedom to choose and the guidance to critically examine and synthesize the available information, instead of relying on a single authored textbook for knowledge, many of our students become authors themselves of authentic projects, presentations, CD ROMs, web pages and papers. As teachers we need to accept the possibilities of what can emerge instead of wanting to control what will develop (Richardson, 1999). Each semester we are surprised by the investment from our students, the quality of the products, and the magnitude of knowledge constructed.

Should the teacher solely deliver instruction? The typical snapshot of the college classroom is the lecture hall filled with students ready to learn from teachers who are the proverbial experts in their field of study. Sharing the responsibility for teaching and learning runs counter to what we have known as instructors and more importantly what students want as learners. To suggest if you give students choices and freedoms

that they will automatically embrace these learning experiences without resistance would be remiss. To alter the power structure within a teaching and learning environment requires both parties to learn to share the responsibility and this evolves as each become more comfortable with the changing roles. To make an abrupt change from a teacher directed classroom to a student-centered classroom is not suggested. Keys to a successful transition include taking time to prepare yourself as an instructor and your students for the change, excellent communication throughout the change, and constructing a range of options so that students with different comfort levels have choices that facilitate their learning. As instructors we find ourselves assisting our students by assessing progress, suggesting revisions and engaging conversations to help students negotiates meaning.

One of the features of technology that enables us to alter the learning environment is connectivity. Connectivity allows learners to carry on sustained discourse about their topic and participate in knowledge negotiation with fellow peers and experts. It allows the dimensions of time and space to no longer restrict learning opportunities. Students are able to shape unique projects representing complex authentic tasks, which include knowledge and theory beyond the classroom walls and the capacity of the teacher. The teaching and learning process is not linear. In our classrooms, students share in the construction and dissemination of knowledge. The teacher doesn't stand at the front of the room as the expert but engages in a dialogue with students as a fellow learner.

Technology offers the opportunity for learning experiences to be authentic, which allows students to make meaning of their topics within real world contexts (Perrone, 1998). Technology allows 1) research; 2) interaction with a community of learners such as peers, instructor, professionals and experts; 3) self-assessment; 4) revision; 5) problem-solving; 6) organizing; 7) synthesizing; and these components are repeated cyclically and in a variety of combinations, which demands an extended investment of time from all involved. Technology assists teachers and learners to overcome the barriers and constraints of time and space that a traditional classroom imposes. Table 1 Methods for Integrating Technology demonstrates a few of the ways in which we have integrated technology rich learning experiences into our innovative classrooms.

Table 1: Methods for Integrating Technology

Technologies and Purpose	**Uses**	**Advantages**
• Communication – Class		
○ Message Boards	Clarification Share information Collaborate	No time constraints
○ Class Listservs		
○ E-mail		
• Develop Expanded Learning Community		
○ E-mail	Interact with experts and professionals Communicate ideas Validate ideas Research, evaluate information Self-assess and revise	Beyond the classroom Real-time communicatio n Immediate feedback Authentic task
○ Chats		
○ Desktop videoconferencing		
○ WWW for research information and inquiry, investigation for names of professionals and experts		
• Document Discoveries		
○ Digital Cameras	Real-life experiences Solving problems	Visual support Immediate Use
○ Video Cameras		
• Disseminate Student Learning		
○ Create web page	Organize information Synthesize	Multisensory Professional delivery of results
○ Video presentation		

All of these conditions help create classrooms full of uncertainty and differentiated learning and from these dynamic learning environments comes unexpected learning. Instead of finding ways to package the products and processes related to infusing technology into teaching and learning we invite you to create your own path and recognize the value in the unknown. We have learned a great deal in our quest to be innovative instructors and know that our future will depend on not whether we change but how we embrace the change.

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Maryland Technology Outcomes and Performance Assessments for the Beginning Teacher

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Abstract: A Maryland task force consisting of K-12 teachers and coordinators, higher education faculty, Maryland State Department of Education personnel, and personnel from the Maryland Higher Education Commission convened in April 1998 to begin to develop technology outcomes and performance assessment tasks for beginning teachers in Maryland. The draft outcomes developed by this task force were distributed to schools and professional organizations for feedback. The task force lead by the Maryland State Department of Education applied for and received a PT3 Catalyst Grant to continue its work. Supported by funding from the grant, the outcomes were revised and draft performance assessment tasks were developed for three of the seven outcomes. In fall 2000, these tasks were piloted on several campuses and work began on the assessments for the remaining four outcomes.

In 1995 Maryland's Redesign of Teacher Education became state law. The law instituted a shift from courseware hours to demonstrated knowledge and skills, a move to accountability and assessment. Technology was identified as an area in the redesign that would be assessed. To define Maryland Teacher Technology Outcomes and performance assessment tasks for beginning teachers, a University System of Maryland (USM) task force was convened in April 1998. The task force consisted of K-12 teachers and coordinators, higher education faculty, Maryland State Department of Education (MSDE) personnel, and personnel from the Maryland Higher Education Commission (MHEC). During spring and fall of 1999, the draft outcomes developed by this task force were distributed to schools and professional organizations for feedback.

During this same time, the task force lead by MSDE applied for and received a PT3 Catalyst Grant to continue its work. The purpose of the grant is to ensure that teacher candidates are prepared to use technology in the classroom for teaching and learning. The task force membership was then expanded to create the Maryland Technology Consortium. The consortium included the original task force members, representatives from additional institutions of higher education and additional local schools, more representatives from MHEC and MSDE, and representatives from the Human Resources Research Organization and from the Regional Technology in Education Consortium.

The goals for the Maryland PT3 Catalyst Grant are 1.) curriculum redesign with provision for curriculum and field experiences for teacher candidates, 2.) development of consistent and credible performance standards and assessments to measure technology-related competencies of teacher candidates, and 3.) candidate development of electronic portfolios that incorporate technology-related performance assessments.

Supported by funding from the grant, the outcomes were revised and draft performance assessment tasks were developed for three of the seven outcomes. The revised outcomes address the following areas:

I. Technology Information Access, Evaluation, Processing, and Application,
II. Technology Communication,
III. Legal, Social and Ethical Issues,
IV. Assessment for Administration and Instruction,
V. Integrating Technology into the Curriculum,
VI. Adaptive and Assistive Technologies,
VII. Professional Growth.

As work on the performance assessments progressed, modifications were made to the outcomes.

In development of the performance assessment tasks, each task description was to include form, audience, topic, and purpose. The assessment task materials included the technology outcome, the technology indicators, the knowledge and skills needed to perform the task, a task summary, the scoring tool and criteria for evaluation, benchmarks, instructor notes, and curriculum connections. During year 1 of the grant the performance assessment tasks for outcomes 1, 2, and 7 were developed. The assessment tasks are:

Outcome I Task

Create an electronic research product for an intended audience using a variety of on-line resources related to a specific content question or problem.

Outcome II Task

Use technology effectively and appropriately to communicate information in a selected format. The ultimate goal is to create a web page to publish the information gathered for the selected topic.

Outcome VII Task

Task A. Part 1: Based on established criteria for evaluating quality on-line resources, identify at least three different emerging technologies along with relevant sources of information. Part 2: Select one of the emerging technologies. Write a reflective, analytical paper for your intended audience to describe how and why this technology could impact teaching and learning. *Task B.* Develop a Technology Professional Development Plan for continued growth in the use of technology to promote learning.

In fall 2000, year 2 of the grant, the three performance tasks were piloted on several campuses and work began on the remaining four outcomes. In spring 2001, the results of the pilot will be used to revise the tasks and determine benchmarks for the assessments. The remaining four performance assessment tasks will be completed and the consortium will begin researching and developing a process for creating electronic portfolios.

In fall 2001, year 3 of the grant, the consortium will continue its work on development of a prototype for electronic portfolios. State regional meetings will be convened to disseminate the outcomes and performance assessments and full-scale implementation of the outcomes and assessments within Maryland higher education will begin. Eventually, all teacher candidates will be required to perform at a satisfactory level on the Maryland Technology Performance Outcomes and this will become a part of the state program approval process.

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A Partnership for Training Teachers: Using Technology-Rich Cohorts

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Abstract: Transforming Learning and Teacher Preparation through Technology-Rich Cohorts is a Preparing Tomorrow's Teachers for Technology grant awarded to National-Louis University. This university is working with three school districts, Milwaukee Public Schools, Prince George (Maryland) Public Schools, and Prince William (Virginia) County Schools to train technology-proficient teachers in these districts. NLU recruits the preservice teachers who are provided with laptops and provides the faculty, while the districts provide the classrooms and computer labs. This paper is a description of the program to date working with the Milwaukee Public Schools.

Today's preservice teachers will be teaching the workers of tomorrow. These future workers must be trained for a world where projections indicate that five of the ten fastest growing job areas will be computer related (College Planning Network 1996). However, teacher training institutions are only beginning to respond to the need to train teachers who can provide these technology proficient students. Barksdale (1994), in a survey of graduates of teacher education institutions, found that fifty percent of the graduates felt that their training for technology integration was not adequate. At the same time, the National Council for Accreditation of Teacher Education (NCATE, 1997) estimated that 2 million new teachers will be hired in the next decade, creating an immense opportunity to train these technology-literate teachers. Indeed, to remain accredited through NCATE, teacher training institutions must demonstrate that they are addressing the need to train teachers in the use of technology (NCATE, 1997).

Research by the International Society for Technology in Education (ISTE, 1999) explored several methods of training teachers to use technology. They surveyed teacher education institutions and found that many institutions had separate educational technology courses for their preservice teachers. These institutions did not routinely require the use of technology during field experiences. Yet ISTE research concluded that technology infusion directly into the training program of preservice teachers such as their field experiences, demonstrated more success than separate these separate technology training classes.

In response to the need for training technology-adept teachers, a partnership between National-Louis University and the Milwaukee Public Schools in Wisconsin, Prince George's County Schools in Maryland, and Prince William's County Schools in Virginia was made, with the goal of combining their efforts to train teachers who will be fluent in technology integration for the participating schools districts. Funded by a PT3 grant, *Transforming Learning and Teacher Preparation through Technology-Rich Cohorts*, National-Louis University (NLU) is providing the faculty to teach the courses including technology experts who assist in technology integrated lessons in field experience and is recruiting the preservice teachers who will each be provided with a laptop computer to use. These students become members of a cohort group of students who complete teacher certification in 18 months. The teacher certification program that these NLU students take is

the same as the traditional teacher education Master of Teaching program except that these students are required to take a course in educational technology that is an elective course in technology for traditional NLU teacher certification cohorts. This class is integrated into the other teacher education courses, with the content and technology faculty working together to provide optimal relationships between traditional teacher certification content material and the technology requirements of this technology course. The goal of these professors is to offer the technology infusion in such a way that the candidates are provided not only with assignments for their coursework but at the same time, allowed an opportunity to interact with software commonly used in the K-12 schools. This technology infusion is designed to meet those skills identified by ISTE as the National Educational Standards for Teachers. In addition, the assignments for this technology course and the teacher education courses are developed as integrated assignments with a goal of creating artifacts for an electronic portfolio for each student.

The participating school districts are providing the location for the teacher education classes, the necessary computer labs for the training, and the clinical placements in technology-rich classrooms for the preservice teachers. These districts have been selected based on several characteristics. They must be a district with a significant number of minority students who are receiving reduced-price lunches. They must be able to provide networked computer labs and classrooms for training the teacher candidates, as well as district technology personnel who can provide a certain amount of assistance to the grant in setting up the labs for instruction. Finally, to participate, the districts must experience difficulty in filling teacher positions. Each of the three participating districts meets these qualifications.

Many of the teacher education courses are being provided online to the students who will be able to access the courses through their laptop computers. To facilitate this, a Web site is being set up to house the online courses. In addition, this Web site will provide the central location for the maintenance of an online relationship between all the school districts involved in the program, as well as the teacher education faculty and the cooperating teachers. In addition to the interaction among these project participants, the NLU Arts and Sciences faculty who wish to be involved in the project are being invited to become trained to converse online and to provide their expertise to the preservice teachers and their students. This relationship is intended to be a vehicle for exchanging information on pedagogy and on technology infusion, and to provide an avenue for including content area experts who will be available to add their expertise to the online conversations, i.e. suggesting resources to look for when a preservice teacher assigns his or her students a lesson in a relevant subject area.

Program to date

The program began as a pilot program with the Milwaukee Public Schools, starting with a cohort of sixteen students. The original plan was to begin with two cohorts of twenty students, one elementary and one secondary; however, however, due to the date of the awarding of the grant, only the elementary cohort was assembled. A secondary cohort is being planned for and currently being recruited to begin in January. In fact, a third cohort in elementary education is also expected to begin in January, due to the success and publicity of the program to date and the efforts of the NLU recruiters.

The students are currently taking three of the required courses, Introduction to Special Education, Introduction to Technology in Education and Practicum I. These courses are being taught in a face-to-face manner but in an integrated fashion, one evening per week. Faculty meet frequently to plan the integration. An example of the type of integration was one class in which the activity of the technology class was assistive technology while the activity of the special education and practicum classes was the facilitation of inclusion of students with a disability into the regular classroom. All classes met their separate goals on their separate syllabi.

Classes for the second term are being developed. One of these courses will be a foundations course that is being revised to be primarily an online course. This course provides an example of the type of joint assignment between education courses that occurs for this cohort. A goal of the technology integration for this program is that it serve as a tool for the assignments of the teacher education courses, and allow the preservice teacher to interact with software that is used in the K-12 schools. An example of one of the activities that reflects this philosophy is being planned for this foundations course. One of the foundations faculty plans to require that the preservice teachers develop Web pages using two of the software packages provided by the grant that are used in the local public Milwaukee schools. In this project, students will use their laptops to search the Internet for information on educational theoreticians such as Piaget and Vygotsky. Using *Inspiration* and Filemaker *Homepage*, programs used by the Milwaukee Public Schools, the foundations professor is

requiring cohort students to develop a concept map of one theoretician that will be turned into a Web page with links to pages describing the concepts of the theory. This project will be used in later courses to develop the preservice teacher's concept of the "ideal" school, a Web-based map of a school that reflects the concepts of their theoretician. As a part of this project, students will be required to create their school's policy handbook. This project became a joint project with the technology course whose instructor required the students to develop a handbook on technology operation and Internet usage. This technology assignment was subsumed to become part of the handbook requirement of the foundations course, the policy handbook of the "ideal" school that the preservice teachers will be developing. The result of these combined projects can be selected by the students as an element of their electronic portfolio.

As part of the grant program, cooperating teachers are selected who are generally more active in the infusion of technology in their classes. They are frequently invited to attend the cohort class to receive training in the technology usage. Thus far, three of the cooperating teachers have received training in *Hyperstudio* and *Filemaker HomePage*. Future inservices for other teachers is being discussed. In addition, extra meetings of the cohort outside the class time for the purpose of helping them increase their comfort levels with the laptop computers are being held. These meetings also provide an opportunity for the preservice teachers to interact with additional educational software.

Currently, at the time of this paper, the Web site for housing the online courses and the projected discourse is under development. Training for the Arts and Science professors is in the planning stages. The project director is beginning the arrangement of the cohorts in Virginia and Maryland. Publicity for the program continues based on its current success. Indeed, the program attracted the notice of one of the local legislators in Milwaukee who attended the class one night. Expansion of the program and replication for the program with its current success is being planned by National-Louis University.

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Scoring for Preservice Teachers' Electronic Portfolios: Issues of Feasibility and Reliability

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Abstract: This paper is a progress report on a pilot study investigating the creation of an impartial, reliable, and feasible method of scoring preservice teachers' electronic portfolios. Participants include four preservice teachers participating in intern teaching and the accompanying weekly seminar. Required portfolio components were developed to demonstrate competency of the INTASC standards. A four-point analytic rubric was created, which provides sub-scores on thirteen portfolio components and one overall portfolio score. Two faculty raters were trained and scored each portfolio. Each portfolio was also self-assessed by its creator and peer-assessed by another intern in the class. Quantitative results include interrater reliabilities of faculty, self, and peer ratings. Qualitative outcomes were studied through open-ended surveys of participants and raters.

Introduction

The assessment and evaluation of teachers, at all levels, is an overwhelming task. Typically, teachers are evaluated on the basis of infrequent classroom observations (Acheson & Gall, 1997). But recent definitions of effective teaching include much more than competent lesson delivery. Recent teaching standards, such as those developed by the National Board for Professional Teaching Standards and the Interstate New Teacher Assessment and Support Consortium, emphasize that teaching requires a combination of complex skills. The concern for assessing the entire range of teaching responsibilities was the inspiration for Stanford University's Teacher Assessment Project (Shulman, 1998). The purpose of this project was to develop and test better means of teacher evaluation. Shulman theorized that combining assessment methods into one portfolio could yield a more authentic, valid, and reliable assessment of teachers. Thus, portfolios arose from this investigation as a better, more authentic way to assess teachers than stand alone methods.

Although teacher portfolios are utilized for a multitude of intentions in different contexts, typical goals of teacher portfolios include the following: (1) Improving teaching and learning; (2) assessing teacher effectiveness, (3) evaluating competency for certification purposes; and (4) strengthening educational programs. Research abounds on the benefits of paper teacher portfolios. Such portfolios have been shown to stimulate teachers to reflect on their instructional decisions (Bartley, 1997; Dutt-Doner & Personett, 1997; Dutt, Tallerico, & Kayler, 1997; Mathies and Uphoff, 1992; Richert, 1990; Stahle & Mitchell, 1993). Portfolios have also been found to be helpful in preparing for and participating in job interviews (Berry, Kisch, Ryan, & Uphoff, 1991; Dutt-Doner & Personett, 1997; Mathies and Uphoff, 1992; Winsor & Ellefson, 1995). Several preservice educators have also reported that portfolios allow them to assess teaching abilities not seen in classroom observations (Berg & Curry, 1997; Ekbatani and Pierson, 1997; Johnson, 1999; Stahle & Mitchell,

1993). Finally, it has been suggested that preservice teachers who construct their own portfolios are likely to use portfolios with their own students (Grant & Huebner, 1998; Taylor, 1997).

Several drawbacks exist, however, with using a paper medium for teacher portfolios. Skills such as lesson delivery and communication cannot be assessed with paper and pencil. Additionally, paper portfolios may quickly become huge stacks of paper, which are unmanageable for the reader. Other practical problems such as storage and reproduction can seriously affect the feasibility of paper portfolios.

Many of these disadvantages have been solved with the advent of multimedia electronic portfolios, which allow for easy storage and reproduction of teaching artifacts, and also the inclusion of a variety of media forms (Tancock & Ford, 1996). Electronic portfolios are quickly becoming popular assessment tools for both K-12 students and preservice teachers, and are showing similar benefits as their paper counterparts. Recent research, for example, has shown that preservice teachers who create electronic portfolios are encouraged to reflect on their teaching (Biddle, 1992; Jackson, 1998; McKinney, 1998).

Although the utilization of electronic portfolios is becoming widespread at both the K-12 and college levels, at the time of this study no research exists concerning attempts to create reliable techniques for scoring these portfolios. If such portfolios are used in high-stakes decision making such as student grading or certification, reliable scoring is essential. This paper will describe one attempt at creating an impartial, feasible, and reliable method for scoring preservice teachers' electronic portfolios.

Portfolio Development

The participants in this study were four preservice teachers participating in their intern teaching experience at Lehigh University during the Fall 2000 semester. Two of the teachers were seeking elementary certification and two were seeking secondary certification. The setting for this study was a weekly intern teaching seminar session, which involved discussion of pertinent instructional topics and instruction in electronic portfolio development.

Student teachers in the seminar were required to create electronic, Web-based portfolios, filled with artifacts from their intern teaching experiences. The portfolio requirement was developed to more authentically assess student teachers, to stimulate self-reflection, to provide a job search tool, and to encourage the interns to use electronic portfolios in their own classrooms. Before the seminar, it was determined that a set of standards was necessary to provide structure to the portfolios and to determine what competencies the interns would demonstrate in their portfolios. Because of their wide acceptance and broad application possibilities, the INTASC standards were chosen to direct the electronic portfolio guidelines. The researchers generated portfolio artifacts that would demonstrate each INTASC standard, and then developed portfolio guidelines based on these artifacts. The following table (Tab. 1) lists the portfolio components and the corresponding INTASC standards.

PORTFOLIO COMPONENT	INTASC STANDARDS TO DEMONSTRATE
1) Introduction, including autobiographical statement, resume, and purpose(s) of the portfolio	N/A
2) Philosophy of teaching and learning	1, 2, 4, 5, 6, 8, 9
3) Interdisciplinary unit	1, 2, 3, 4, 6, 7, 8, 9
4) Classroom management plan	5, 7
5) Family communication plan	6, 7, 10
* 6) Teacher-created student assessment (*May be included in interdisciplinary unit)	1, 2, 3, 4, 7, 8
* 7) Lesson plan designed using student assessment data (*May be included in	1, 2, 3, 4, 7, 8

interdisciplinary unit)	
* 8) Lesson plan that meets the needs of diverse learners with differentiated instruction (*May be included in interdisciplinary unit)	1, 2, 3, 4, 7, 8
* 9) Lesson plan that requires *student* use of technology (*May be included in interdisciplinary unit)	1, 2, 3, 4, 7, 8
10) Video clip of teaching	1, 2, 3, 4, 5, 6
11) Evaluation of teaching resources	1, 2, 4, 6
12) Reflection for each of components #3, 6-10	9
13) Reflection on the entire portfolio Process	9
14) Student self-assessment (rubric)	9
15) Peer-assessment (rubric)	9

Table 1: Portfolio components and their corresponding INTASC standards.

The provision of specific expectations alleviated possible concerns about "what to include," provided the structure necessary for fair scoring, and allowed the interns to concentrate their energy on the quality of their artifacts and the necessary technology-based competency skills.

Based on the guidelines, a rubric to score the portfolios was created by the principal researcher and endorsed by a group of Lehigh University faculty in the Technology-based Teacher Education program. The rubric details all the necessary characteristics for each portfolio component. A score of one (novice), two (developing), three (proficient), or four (exemplary) is possible on each of the thirteen components of the rubric: (1) Organization; (2) Spelling/grammar; (3) Philosophy; (4) Interdisciplinary unit; (5) Classroom management plan; (6) Family communication plan; (7) Teacher-created student assessment; (8) Lesson plan designed using student assessment data; (9) Lesson plan meeting the needs of diverse learners; (10) Lesson plan requiring student use of technology; (11) Video clip of teaching; (12) Evaluation of teaching resources; and (13) Reflection statements. For example, a score of novice (one) on organization is characterized by the following: "No apparent organization was attempted. Large parts are incomplete. Very difficult to follow." A score of exemplary (four) on the same category requires that "organization is clear, well thought out, creative, readily apparent, and easy to navigate. All artifacts are labeled according to required component names." Similar qualifiers are used throughout the rubric in each category. The scoring rubric was introduced and thoroughly explained to the interns in the first seminar meeting. It was emphasized that they should refer to the rubric throughout the portfolio development process.

After the portfolios are submitted, at least three raters will score each of the four portfolios. Additionally, each portfolio will be self-assessed by its creator and peer-assessed by another student in the seminar. Interrater reliabilities will be calculated for the three raters' scores of each portfolio. Percent agreements between rater and self, rater and peer, and peer and self will also be computed. Finally, study participants will complete a survey regarding their perceptions of the electronic portfolio development process, including their general preparedness for creating electronic portfolios, their perceived usefulness, the quality of the rubric, and suggestions for improvements. Study participants will be asked to select true or false to each of several survey statements. They will also be encouraged to provide open-ended responses to questions regarding possible improvements to the development process.

In order to collect data concerning the scoring process, open-ended interviews will be conducted with each of the three portfolio scorers. The interviews will attempt to determine the perceived feasibility, validity, and efficiency of the rubric. Scorers will be asked to provide possible improvements to both the portfolio development and scoring processes.

Initial Findings and Discussion

Initial findings regarding the portfolio development process are emerging. First, similar to findings from other studies (Berry, Kisch, Ryan, & Uphoff, 1991; Dutt-Doner & Personett, 1997), the interns in this study displayed initial anxiety when charged with the creation of electronic portfolios. Questions abounded during many of the weekly seminars; the interns overwhelmingly relied on the instructors to answer their questions, rather than reference the rubric specifications. The instructors had to explicitly remind the students that the rubric described the characteristics necessary for quality artifacts.

The time and energy required to complete entire electronic portfolios and simultaneously completing intern teaching was an issue that consistently emerged during the seminar meetings. Three interns agreed that requiring selected components throughout their preservice courses would simplify the final production of their portfolios. One intern, however, expressed that all of his artifacts were of a higher quality because he was now experiencing real classroom life. For example, he shared that although he created an interdisciplinary unit in a previous methods course, he now realized that the unit was not practical and would not be successful in a real classroom. The researchers and the Teacher Education faculty at large intend on investigating the possibility of requiring selected portfolio components throughout the preservice program.

The interns' frustrations with the technological demands of creating an electronic portfolio clearly overshadowed any concerns about time, however. It was intended that the portfolio instruction focus on teaching and learning, but technological trouble-shooting soon dominated class time. The interns unanimously lacked prerequisite technological skills and did not have home access to necessary hardware and software.

It quickly became clear to the instructors that remedial pedagogical strategies were required. Two doctoral students, both well-versed in instructional technology, were enlisted as assistants in the weekly work sessions. The luxury of having four instructors and only four interns allowed for individual tutoring and support. This support was an absolute necessity in this context; it is recognized that such assistance is not available in most situations.

Before the interns could learn about basic web page development, they first had to learn simple computer skills such as organizing, saving, and naming files and folders. Templates including links to each required component were provided to students; the interns were subsequently instructed on basic functions of Dreamweaver. Students had access to the lab computers and Dreamweaver throughout the week. Unfortunately, none of the interns took advantage of this access; the interns all created their documents at home and brought them to class to cut and paste them into the program. As interns made progress on their portfolios, instruction included skills more relevant to portfolio construction: visual concept maps were used to illustrate how portfolios are organized.

One possible way for improving this process is to require interns to acquire an html editor for use at home. Relying solely on campus computers and not having the capability of working at home was a clear shortcoming for the interns. It is also evident that the preservice program must better integrate technological requirements throughout program courses and requirements. This is already being done at the college; the preservice program now includes a mandatory core course, which provides instruction in teaching and learning with technology. This course will include instruction in basic web design; an important prerequisite for electronic portfolio construction. It is hoped by the researchers that future students will therefore be better equipped with the technological skills necessary for creating electronic portfolios.

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MU Partnership for Preparing Tomorrow's Teachers to Use Technology
SITE 2001 Conference Paper

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Abstract:
This interactive session will describe the processes, instruments, and data collected from the University of Missouri-Columbia College of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant. The goals of the grant include:

1. Faculty fluency with technology as a tool for themselves as instructors and as a subject for improving and changing methods of teaching in K-12;
2. A revised curriculum for teacher education that utilizes technology (ISTE NETS Standards) and prepares future teachers to be technology users;
3. A set of internet-based tools for enabling the teaching and learning processes of teacher education (ShadowPD netWorkspace);
4. A total quality management (TQM) process modeled after continuous improvement processes that are proving effective in sustaining change and improvements in business and industry.

The expected outcomes of this project are: faculty and teacher education students who are fluent in the use of technology in teaching, high quality experiences with technology in teacher education curriculum, tight integration of the curriculum with exemplary technology-using practices of K12 teachers, and a program that is sustainable, owned by faculty, and continuously improving.

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Faculty Development Process

Purpose

The ultimate purpose of all PT3 grants is, as the name clearly says, to "prepare tomorrow's teacher's to use technology". What isn't explicitly stated but is clearly implied is that we are preparing them to use technology to enhance learning. The faculty development activities of the MU PT3 grant are all focused on this idea of not just increasing technology use, but increasing a specific type of technology use -- uses that support learning. In this section we briefly describe our activities and results in this grant area for year one, as well as our plan and initial activities for year two.

Participants

The participants for this portion of the grant consist of two cohorts of faculty who teach methods courses in content areas such as educational foundations, literacy, social studies, math, art, music, and early childhood in the undergraduate teacher preparation program. The members of each cohort included approximately 12-14 full-time faculty members teacher educators who participated in the professional development process. In addition to these primary members, other individuals who teach our K-12 pre-service teachers, such as graduate assistants and adjunct instructors, were also included in professional development activities. All cohort members receive a financial incentive as part of their participation in the grant. These incentives varied amongst faculty members but included such things as a one course buy-out, graduate student support, hardware/software, or travel money.

Year One Activities
Our faculty development in year one was based upon an individualized or customized learning philosophy. Most faculty development activities were delivered in a one-on-one setting focusing on that faculty member's current needs and learning goals. We felt this was the best way to create an effective learning environment that would work for these already-busy faculty members.

We developed these activities based upon the results of our first step, a needs assessment. We administered a questionnaire, and conducted individual faculty interviews to identify cohort one's needs. These instruments provided descriptive data that allowed the team to develop individual user profiles, determine needed hardware/software, and identify individual learning needs. The results of these activities showed that faculty in cohort one needed and wanted to work on improved technology skills in addition to then adding effective uses of technology to their pre-service teacher methods courses.

Second, we developed individual profiles for each member of cohort one; these were used to develop individual learning plans. Each faculty member worked with an educational technologist to identify personal learning goals and a plan to attain the goals. Each faculty plan varied in specific learning experiences, but all plans focused on developing fluency with technology and integrating technology tools into methods courses.

Third, to meet the goals of individual faculty, each participant was assigned a technology tutor who was a part-time student hired by the grant to assist faculty in meeting their technology learning goals. The student tutors - Student Wizards Assisting Teaching (SWAT) - were an integral component of the professional development process. The faculty member and the SWAT member met for two to three hours each week of the semester in the faculty member's office for tutoring sessions. Each session was guided by the faculty members learning goals (i.e. learning basic skills, learning to develop web pages etc.). Following the weekly tutoring sessions, the SWAT members met with the educational technologist to review faculty progress, answer SWAT members technical questions, and trouble shoot problems raised by the faculty participant.

Fourth, in addition to individual tutoring sessions, professional development experiences were provided to increase the cohort's awareness of technology uses in a wide variety of areas. We intended these opportunities to build general awareness about technology tools and uses. These activities included luncheon sessions where we demonstrated learning software, field trips to K-12 technology-rich classrooms, a day long seminar where the integration of technology and curriculum was demonstrated, and opportunities to work with K-12 teachers who were interested in helping extend technology use into the public schools.

At the end of the semester of professional development activities, a PT3 co-PI interviewed each cohort member to ascertain their perceptions of the professional development experiences. These results as well as examples of faculty technology activities will be discussed during our interactive session.

Year One Data Sources
Of course, a critical part of this process is assessing and evaluating the effectiveness of the faculty development efforts. To this end, we gathered a variety of data. Data sources included a variety of report forms, reflections, interviews and artifacts. The sources used to create each faculty member's profile included: a) initial interviews that focused on establishing learning goals, curricular revision plans, and technology integration strategies and b) a skills survey that helped to identify current faculty technology skills and uses. Additional data sources included artifacts such as course syllabi from before and after professional development activities and descriptions of course projects. These artifacts were used to identify the extent to which faculty had integrated technology into their courses prior to the professional development semester.

Year Two Activities
Year one of the grant ended in late September. At the writing of this paper, we are just beginning activities with our year two cohort. We are basing our year two activities upon our successes and feedback for areas of improvement for year one. Although we anticipate many things will remain the same (e.g. the support of the SWAT team and individual professional development sessions with faculty and educational technologist), this year we are encouraging faculty to consider adopting uses of technology as "mindtools" or cognitive tools. Mindtools, or cognitive tools, are "computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning" (Jonassen, 2000). Students cannot use these tools without thinking deeply about the content that they are studying, and second, if they choose to use these tools to help them learn, the tools will facilitate the learning and meaning making processes. Cognitive tools include (but are not necessarily limited to) databases, spreadsheets, semantic networks or concept maps, expert systems, computer conferencing, multimedia/hypermedia construction, and microworld learning environments. The underlying premise is that if our teacher development faculty model the use of technology as mindtools in their methods courses, students will be likely to emulate these uses of tools in their future classrooms -- ultimately the goal of our grant!

As in year one, we began with a needs assessment. Again, we will administer specific questionnaires concerning cohort two's technology skill levels, current hardware and software tools and their hardware and software needs. Based upon year one feedback and observations, we decided we needed an additional type of information from our cohort faculty in order to create an effective faculty development program. Although we still needed to know about their hardware and software skill levels and needs, we also need to understand more about their desired learning outcomes for their students. If we want them to adopt uses of technology to support learning, then we need to understand what types of learning we need to support. To this end we conducted focus groups with cohort faculty. Focus groups consisted of between two and five faculty members from similar discipline areas (e.g. math and science educators). The goals of the focus groups were as follows.

- Determine the desired learning outcomes for the undergraduate teacher development courses in their discipline and grade level areas (e.g. "what outcomes do we want for our middle school social studies pre-service teachers?").
- Determine how technology is currently being used in these classes to support learning (e.g. this course is currently delivered in a web-assisted manner).
- Determine what existing interests faculty have about using technology to support learning (e.g. "I'd like to learn more about how to use spreadsheets to support learning.").

Our analysis of focus group notes resulted in scheduling a suite of five workshops on various ways technology can be used to support learning. The workshops we will offer are:

- Building simulations with spreadsheets
- Representing Complexity by Building Cognitive Flexibility Hypertexts
- Helping Kids Represent What They Know with Concept Maps
- Helping Kids Think Like Experts: Predicting and Decision Making with Expert Systems
- Developing Cases for Case-Based Instruction

At this writing we are in the process of scheduling these workshops. All workshops will be hands on ; faculty will work at a computer to both learn new software, and more importantly, the pedagogical bases for using the software to support learning. Workshops will be open to our cohort faculty, graduate teaching assistants in the teacher development program, K-12 teachers who partner with our faculty, and other interested faculty from the college of education. Our student SWAT team members will also attend and we will conduct follow-up sessions with them on these uses of this software so they can effectively support faculty after the workshops.

Total Quality Management Process

Purpose

TQM dictates that there be ample feedback within the areas of the PT3 grant and the Teacher Development Program (TDP) to determine the advancement of the purpose of the TQM project, and to inform the process for adjustment and achievement purposes. The evaluation for the MU PT3 grant will focus on the following critical control points as feedback and research items as suggested by the Malcolm Baldridge Standards for Total Quality Management for Education. This will ensure that technology is integrated in the TDP, that TDP students will meet ISTE Standards, and that technology integration will be sustained in the TDP.

1. Supporting the annual revisit of the goals of each area of the grant, including all the appropriate sub-areas.
2. Coordinating the collection of data where possible.
3. Identifying data collection points.
4. Releasing data findings appropriately to inform related critical control points.
5. Improvement of Communication within the Grant and between the Grant and TDP.

Data Collection

Data collection is identified as Phase Markers according to the structure of the MU Teacher Development Program (TDP) and aligned with ISTE NETS Standards. Each area represents Entry Level data collection and Exit Level data collection from our students.

Students Entry Level

1. Technology Self Assessment /Attitude & Importance Survey. This survey would be given at the beginning of each Phase and may be revised for the different Phase levels according to feedback and ISTE Standards. Technology skills would include: email, internet browsing/searching, word processing, digital images (scanning), audio editing, web authoring, multimedia presentation software, database, spread sheet, desktop publishing, computer file management, and troubleshooting.
2. Technology Performance Assessment

3. Course Reflection - Topics would include: Reflection as an Independent Learner and Reflection concerning using asynchronous learning methods.
4. Initial Student Feedback Interview

Students Exit Level

1. Classroom Integration Evaluation: Student Level of Use Survey - Students identify alignment of Syllabus Review with technology integration. Purpose to get feedback from students concerning the integrated activities in their coursework. Specific questions can be added to the current feedback surveys used by individual instructors if available.
2. Portfolio Evaluation for Technology Elements. What technology elements are there, and what are the quality of student experiences?
3. Student Interview Feedback

Student Critical Control Points

Phase One	Phase Two	Phase Three	Phase Four
Technology Self Assessment	Technology Self Assessment	Technology Self Assessment	General Integration Feedback CAPS
Phase One Technology Performance Assessment	Phase Two Technology Performance Assessment		Attitude Level of Use and Importance Survey
Feedback Assessment from ED101 Technology Skills for Teachers	Feedback Assessment from ED201 Technology Skills for Teachers	Certification Portfolio Evaluation	
Student Feedback Interview	Student Feedback Interview	Student Feedback Interview	
Flashlight Surveys by Methods Instructors	Flashlight Surveys by Methods Instructors	Flashlight Surveys by Methods Instructors	

Grant Area Critical Control Points

Learning Communities	<u>Mentor Teachers</u>: 1) Attitude, Level of Use & Importance Survey <u>Field Experience Site Evaluations</u>: 1) Technology Availability Survey		
Prism	<u>Instructors & Faculty Cohort 1</u>: 1. Syllabus Technology Integration Identification 2. Attitude Level of Use and Importance Survey 3. Classroom Interviews 4. Focus Group Feedback	<u>Instructors & Faculty Cohort 2</u>: 1. Syllabus Technology Integration Identification 2. Attitude Level of Use and Importance Survey 3. Classroom Interviews 5. Focus Group Feedback	**SWAT Team** 1. Informal feedback and reflections of members 2.Activity and Progress Reports **Reflector Staff:** 1.Level of Support Analysis 2. Informal Feedback
Shadow PD	1. User Feedback	2. Usage Statistics	
TQM	Purpose: To oversee and assist in data collection and analysis in other areas. 1) Maintain the Research Agenda 2) Maintain the Research Outline 3) Technology Self Assessment		

Instructor Evaluations

Award Winning Technology Using Teachers	eMINTS Teachers	Nominated Technology Using Teachers
Attitude, Level of Use, and Importance Survey		Attitude, Level of Use, and Importance Survey
Benchmark Evaluation: Classroom Observations of Technology Integration	Benchmark Evaluation: Classroom Observations of Technology Integration	Classroom Observations of Technology Integration

Description of Data Collection Items

1. Technology Self Assessment: A self-assessment that indicates the level of proficiency on 15 different technology innovations, and the identification of importance of each innovation to the respondents future teaching and learning.

2. General Integration Feedback CAPS: An assessment conducted by the TDP to assess the strengths and weaknesses of the teacher preparation program.
3. Technology Performance Assessment: A performance evaluation to determine skill based competency for a group of technology skills.
4. Feedback Assessment from ED101 Technology Skills for Teachers: This instrument consists of a set of questions for students who are taking a course to learn basic technology skills.
5. Student Feedback Interview: Randomly selected students from each of the three phases in the Teacher Development Program are selected each semester to determine how they are making meaning in their program
6. Flashlight Surveys: These surveys are offered on the Internet. Instructor's customs build an assessment that is particular to their class and teaching situation to determine the impact of technology integration in coursework and learning.
7. Class Room Observations of Technology Integration: Instructors are interviewed and observed to determine their integration strategies and successes.
8. Attitude, Level of Use & Importance Survey: A technology integration survey that determines the integration strategy, the level of use of technology innovations, and how important teachers feel the innovation and integration is to their teaching and students learning.
9. Technology Availability Survey: This instrument is used to determine the kinds of technology equipment, amount of technology availability in field experience classrooms.
10. Syllabus Technology Integration Identification: Teacher development program instructors' syllabi are examined for evidence of technology integration..
11. Focus Group Feedback: Informal interviews are conducted to get feedback that will guide the formation of Learning Communities made up of K-12 teachers and faculty.
12. Certification Portfolio Evaluation: A final evaluation of a teacher development student's Program Portfolio, looking for technology integration success.
13. Level of Support Analysis: An analysis to determine the kind and amount of computer lab support delivered to students.
14. Usage statistics: A determination of the number of hits and degree of use of the Shadow PD project.
15. User Feedback: An informal collection of feedback from users of Shadow PD.

ShadowPD

A set of Internet-based tools for enabling the teaching and learning processes of teacher education is being developed to function within Shadow netWorkspace (SNS) (http://sns.internetschools.org). SNS is an Internet-based workspace designed to support teaching and learning in K-12 schools. The core set of functionality found in SNS forms a flexible foundation for a learning community. The ShadowPD project is assisting teacher education faculty at MU in understand how they can use SNS to enhance learning in their classrooms. A quick and rough analogy of SNS is to imagine the desktop of a preservice teacher's (PST) computer existing on the Internet. Using a browser, such as Internet Explorer or Netscape Navigator, the PST connects via a secure login to the SNS Web site and her personal netWorkspace. Here she finds a desktop for accessing the file system, groups, communication functions, and applications. She also has anytime-anywhere access to her own work and applications, she participates in group work through SNS as well. Additionally, she participates in her class work via SNS, as it provides the core functionality of commercial Web-based instructional support systems (e.g., WebCT and CourseInfo).

Through working with the MU teacher education faculty, sharing ideas with other PT3 grant recipients, and reviewing the teacher education literature, the ShadowPD project has identified three problems that a great number of teacher education programs face. These common problems are: how to create a Web-accessible shareable document archives, how to facilitate the creation and maintenance of electronic preservice teacher education portfolios, and how to harness their network's potential to create better communities of practice into which students can be inducted. In addition to helping the MU faculty use SNS, the ShadowPD project is working to modify SNS to support these three important goals of teacher educators.

National University PT3 Project

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Abstract: In the 1999-2000 school year, National University's PT3 Project staff trained 8 NU faculty members and 14 master teachers in a weeklong training series. The training covered a great deal of information, ranging from databases and word processing to publishing and multimedia. The evaluation data indicate that the majority of participants, both faculty and master teachers, were satisfied with the training (with the exception of three novice teachers from one school site). However, follow-up data suggest that faculty members and teachers have had mixed success in implementing their new skills within their classrooms. Some participants enthusiastically reported using their new skills in both their classrooms (primarily using the Internet to locate resources and lesson plans) and in personal activities such as finance and communicating with friends via email. Other master teachers reported that availability of appropriate hardware and time constraints hindered their implementation of the skills learned. Faculty members also reported using resources found on the Internet to enhance their course content, and others reported integrating PowerPoint presentations into their lectures. A CD-ROM containing trial versions of multimedia software used in the PT3 Grant Training will be distributed to attendees.

In the 1999-2000 school year, National University's PT3 Project staff trained 8 NU faculty members and 14 master teachers in a weeklong training series. The project training covered a great deal of information, ranging from databases and word processing to publishing and multimedia. The project also established a consortium of industry partners to support and model technology outside the university community. Industry partners include: Datel (NU's vendor for computer hardware), Lightspan Partnership (a website development company), Qualcomm, Hewlett-Packard, Sony, Pacbell, Cox Communications, the San Diego Supercomputer Center, and the San Diego Electric Training Trust. The PT3 faculty and master teacher training sessions were conducted at NU facilities in January and May 2000. Faculty members received 36 hours of training and master teachers received 24 hours over the course of one week. It was anticipated that faculty members who were trained in March would assist at the master teacher training; however, no faculty members who attended the initial training participated in the teacher training.

The faculty and master teacher training sessions focused on helping participants integrate information about technology into their pre-service courses and classrooms. Sessions addressed the following topics: How to (1) digitize photos and text on a scanner, (2) build web pages with animation, (3) edit student research papers and essays electronically, (4) send and receive emails with attachments, (5) design and develop online courses, (6) use a digital camera, (7) run a camcorder, (8) design weighted spreadsheets for calculating grades, (9) use adaptive technology hardware and software, (10) digitize voices and music for presentations, (11) understand technology copyright and intellectual property rights laws, (12) participate in chat rooms on the Web, (13) design electronic portfolios, (14) create a database for organizing Web resources, and (15) use the "screen capture" function to add embedded computer screen shots to presentations. The training was "hands-on", enabling participants to practice skills and pursue their own ideas about how to utilize technology in their own classrooms. The training facility had 15 computers and a Proxima projection system. Materials provided to participants included two textbooks, diskettes, CD-ROMs containing trial versions of multimedia, instructional software and an Internet browser. Ongoing support to assist participants in implementing skills learned is provided by the project coordinator via email, phone and in-person, if needed. The 22 NU faculty and master teachers were expected to implement the skills and knowledge gained from the training in their teaching and supervisory activities. It was anticipated that pre-service teachers who take courses offered by trained faculty and those who are supervised by trained master teachers would also increase their ability to integrate technology into their own classroom teaching.

Pretest scores indicate that the majority of participants possessed minimal proficiency in all competency areas. Post-test scores indicate that NU faculty members gained proficiency in all except four competencies. More specifically, eight competencies showed an increase in participants' proficiency; three areas decreased, and spreadsheet competency did not change from the pre to post-test. Teachers reported gains in all areas. The trainer

attributed the decrease in the three areas to faculty members' initial over-estimation of their competence in that area; but when faculty received further training, they realized how limited their knowledge of that area actually was. Pre-test scores indicate that master teachers possessed greater proficiency than faculty members in the area of word processing, while faculty members possessed greater initial knowledge in the areas of statistics and networking. The greatest gains from pre-test to post-test were in the areas of presentations and publishing. Faculty ratings in the areas of multimedia and word processing also improved substantially.

Faculty Computer Competency Survey (ratings range from 1 to 4, with "4" indicating "proficient")						
Competency	**Mean Pre-Test Score**		**Mean Post-Test Score**		**Difference**	
	Faculty	Teachers	Faculty	Teachers	Faculty	Teachers
Presentations and Publishing	1.58	1.68	2.53	2.40	+.95	+.72
Multimedia	1.00	1.13	1.92	1.60	+.92	+.47
Word Processing	2.14	2.83	3.08	3.22	+.94	+.39
Internet Proficiency	2.00	2.20	2.65	2.64	+.65	+.44
Educational Software	1.95	2.12	2.34	2.73	+.39	+.61
Computer Operations	2.17	2.01	2.44	2.49	+.27	+.48
Databases	1.70	2.00	2.40	2.20	+.70	+.20
Spreadsheets	2.19	2.04	2.19	2.63	0	+.59
Programming	1.30	1.30	1.20	1.40	-.10	+.10
Networking	1.95	1.30	1.60	1.75	-.35	+.45
Statistics	2.40	1.40	1.93	1.87	-.47	+.47

Figure 1: Faculty Computer Competency Survey

The evaluation data indicate that the majority of participants, both faculty and master teachers, were satisfied with the training (with the exception of three novice teachers from one school site). However, follow-up data suggest that faculty members and teachers have had mixed success in implementing their new skills within their classrooms. Some participants enthusiastically reported using their new skills in both their classrooms (primarily using the Internet to locate resources and lesson plans) and in personal activities such as finance and communicating with friends via email. Other master teachers reported that availability of appropriate hardware and time constraints hindered their implementation of the skills learned. Faculty members also reported using resources found on the Internet to enhance their course content, and others reported integrating PowerPoint presentations into their lectures. One of the eight faculty members reported modifying her course requirements to reflect a greater emphasis on technology. However, with the exception of one course, the majority of students enrolled in courses taught by trained faculty stated that they were not exposed curricula or strategies that prepared them to implement technology in their classrooms. Based on the evaluation data presented in this report, the first three project goals were partially met. Insufficient data were available to determine whether goal four was met. The following recommendations are made based on the data collected and a review of project activities in relation to GRPA criteria:

1. Participating in a weeklong training series proved prohibitive for many prospective teacher-participants. PT3 staff may wish to consider modifying the training for classroom teachers – one day a week for a month, for example.

2. The training met the needs of moderately experienced users, but less so the needs of novice users. Staff may wish to more carefully select target participants who would most likely benefit from the training, or modify the training to meet the needs of a wide range of proficiency levels.

3. Continue to provide on-site follow-up support to training participants. Some participants expressed the desire for further assistance in implementing the skills and knowledge learned in their classrooms.

4. Further support provided to participants should be aligned with project goals and GRPA criteria. For example, helping faculty members incorporate strategies that prepare their students to utilize technology in K-12 classrooms.

5. The ways in which faculty members and master teachers reported utilizing the training varied tremendously from participant to participant. This variation may be reduced if participants receive explicit information about the kinds of activities in which they are expected to engage in following the training.

EVALUATING THE INCORPORATION OF TECHNOLOGY IN HIGHER EDUCATION IN WESTERN PA

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Abstract: Three Pennsylvania state universities (Indiana, Clarion and Edinboro) successfully obtained a 1.73 million PT3 grant. We developed a plan to infuse technology into teacher education programs. We present the evaluation plan for review and comment. The audience consists of people who have a PT3 grant and/or those who are interested.

OVERVIEW

Three Pennsylvania State Universities (Indiana, Clarion, and Edinboro) successfully obtained a 1.73 million PT3 Grant funded by the US Department of Education. The three universities developed a plan to infuse technology into their teacher education programs. Indiana University of Pennsylvania was responsible for developing the evaluation plan for the three years and for overseeing the grant progress.

It is assumed that technology infusion at the three universities will have a significant impact. All three schools are rural, multi-purposed universities with a background as normal schools. Teacher preparation remains an important part of their missions. Alumni of Pennsylvania teacher preparation programs are employed throughout the country as Pennsylvania produces more teachers than it has teacher positions. It is our belief that a successful outcome for this grant's activities will make our students (the three universities graduate over 1500 new teachers each year) even better prepared to work in school districts throughout America.

The major goals of the PT3 Grant are:

1. Instructional Technology will be moved from the periphery to the core of our curriculum.
2. Future teachers will apply and integrate Instructional Technology into the teaching/learning process.
3. Additional faculty, instructional designer and technical support staff will assist. We aim to help faculty to recognize instructional objectives that can be more readily achieved using technology, to upgrade technology skills to a level where appropriate modeling of technology can take place and to assign and assess student work that incorporates technology use.

AREAS TO BE ASSESSED

The areas of activity by pre-service students, recently graduated in-service teachers, and faculty to be assessed using surveys, interviews, and observations include knowledge, attitudes, application, and integration. Knowledge

represents what one knows and can do with respect to the use of technology in the classroom. Attitudes indicate how one feels about the use of technology in the college and K-12 classroom. Application involves the ability to demonstrate the use of technology both in the college and the K-12 classrooms. Finally, integration requires the use of various technologies in achieving the goals of the lesson plan for the college and K-12 classroom. We expect to obtain an overall assessment of each area using a maximum of five self-report items per area.

DEMOGRAPHIC DATA COLLECTION

Demographic data will be collected from all pre-service teachers, recently graduated in-service teachers, and faculty who teach relevant education courses. This will include age, sex, year in school, number of credits, overall grade point average, major courses grade point average, socio-economic background, resident status, major, data available at admission to college, and other relevant information.

INSTRUMENTS

We developed Faculty, Student, Student Teacher, Teacher, Syllabus, and Workshop (both individual and group) assessment instruments. They will be presented for review during the presentation at the SITE 2001 conference. Instruments are also available from the presenters, who welcome e-mail requests.

YEARS AND COHORTS

There will be three years of evaluation with three pre-service teacher groups each year: sophomore, junior, and senior education majors. Each year there will be a faculty group and a recently graduated in-service teachers group. We expect that there will be 2,061 sophomores, 1,927 juniors, 1,898 seniors, 325 faculty, and 1,514 recently graduated teachers.

	YEAR 1	YEAR 2	YEAR 3
Evaluation	Finding/Developing Instruments Baseline Survey Year #1 Conduct Faculty Surveys Conduct Student Surveys Conduct Teacher Surveys Collect Demographic Data Year #1 Syllabi Year #1 Collect Portfolio Samples Year #1 Focus Groups Year #1	Baseline Survey Year #2 Conduct Faculty Surveys Conduct Student Surveys Conduct Teacher Surveys Collect Demographic Data Year #2 Follow-up Year #1 Faculty Students Teachers Syllabi Year #2 Collect Portfolio Samples Year #2 Focus Groups Year #2	Baseline Survey Year #3 Conduct Faculty Surveys Conduct Student Surveys Conduct Teacher Surveys Collect Demographic Data Year #3 Follow-up Year #1 Faculty Students Teachers Follow-up Year #2 Faculty Students Teachers Syllabi Year #3 Collect Portfolio Samples Year #3 Focus Groups Year #3

Table 1: Evaluation Timeline

BASELINE DATA COLLECTION

Baseline survey data for all cohorts will be collected during the initial year of participation for each cohort. Initial demographic data will be collected during the Fall of each year. All cohort members will be surveyed using the evaluation instruments. Further, we will collect syllabi from the faculty cohort for the education classes they teach. Finally, we will collect copies of portfolios from the senior cohort. Current data analysis in the form of Confirmatory Factor Analysis (assuming the data display the appropriate necessary assumptions) will be done to further bolster the assessment of the validity of the evaluation instruments. Also, Exploratory Structural Equation Modeling (assuming the data display the appropriate necessary assumptions) will be used to examine the factor structure of surveys and possible causal relationships. The demographics of the baseline sample will be compared with the population data from the consortium universities in an attempt to assess the extent to which the baseline sample represents the population.

FOLLOW-UP DATA COLLECTION

Follow-up data will be collected from each cohort during successive years of the project. Further, longitudinal analysis using analysis of variance with repeated measure will allow us to examine the means structure of the cohorts over time. Structural Equation Modeling approaches will allow us to look at the changes in factor structure and possible causal relationships over time. Further, we will collect syllabi from the faculty cohort for the education classes they teach. Finally, we will collect copies of portfolios from the senior cohort.

The demographics of the follow-up samples will be compared with the baseline data and population data from the consortium universities to assess the changing nature of the cohort samples and populations.

Every attempt will be made to incorporate the collection of follow-up data into the standard operating procedures of the consortium universities.

FORMATIVE AND SUMMATIVE EVALUATION

Both formative and summative approaches to evaluation will be used in this project. Formative evaluation will help us understand any success we may have along the way and highlight the need for mid-course corrections to the direction we are taking. Summative evaluation will help us understand the final results of the project and will be a natural precursor to dissemination through presentations and publications.

Formative evaluation will be accomplished through the comparison of baseline survey data and follow-up survey data for each year of the project. Also, we will examine the increases in the use of instructional technology through the evaluation of faculties' course syllabi and graduates' portfolios from year to year. Finally, the qualitative information garnered from the focus groups will be a valuable source of formative evaluation data.

Summative evaluation will be accomplished through examination of the final follow-up survey data for each cohort and the graduates' portfolios. Real proof of the value of the project will be in the level of use of instructional technology by in-service teachers. If, after all of our efforts, the graduates of the consortium universities do not have high levels of instructional technology use in the K-12 classroom, then our efforts will not have had the effect we wanted.

GOALS, OBJECTIVES, AND EVALUATION

Goal 1- Overview

To infuse instructional technology more deeply into the teacher education curriculum in both education core courses and selected majors. Students will be taught technology and it will be modeled by faculty teaching in the college of education core curriculum. In addition, technology modeling and application will occur within subject area courses. To evaluate this goal we will analyze survey data for each year's cohorts and over time, i.e. baseline data for the year one cohorts, follow-up data for year two for the same yearly cohorts, and follow-up data for year three for the same yearly cohorts. We will examine this data using analysis of variance with repeated measures, confirmatory factor analysis, and exploratory structural equation modeling. Further, we will evaluate in-service teachers' portfolios for the use of technology in their various teaching projects and teaching experiences using rubrics for consistent scoring. We will examine the portfolios each year and across years for change. And, we will examine the use of technology for teaching in the syllabi of faculty and look for changes in the syllabi across years. Finally, the information from the focus groups will assist in the evaluation of this goal.

Objective 1

Train faculty to effectively and appropriately use and teach the eleven key competency skills. This objective will be evaluated by basic record keeping of attendance by faculty at workshops. Further, simple workshop evaluation forms will document that faculty believe that they have learned how to utilize the 11 competency skills.

Objective 2

Have university faculty model how to teach effectively with technology in education core courses and elementary education/subject area courses. The collection, collation, and analysis of syllabi by the same faculty for the same courses over time will allow us to evaluate this objective.

Objective 3

Create assignments within education core and subject area courses based upon the appropriate use of the eleven competencies. Pre-service teacher and faculty survey sub-scale data will be used along with qualitative data generated by focus groups.

Objective 4

Revise course syllabi to reflect and recognize the integration of technology into the curriculum. Analysis of syllabi will be used for this objective used along with qualitative data generated by focus groups. Further, pre-service teacher portfolios will be examined across years to look for changes in the kind of assignments students' enter in their portfolios.

Goal 2 - Overview

Integrate instructional technology in the consortium's pre-service observation and field experiences. This will be accomplished by observing the best teachers in public schools through the use of video-conferencing equipment. These observations will include interviews with school personnel, including teachers, administrators, staff, etc. There will also be moderated chat room discussions about these observations. This goal will be evaluated in much the same way that the first goal was evaluated, but by using only the pre-service teacher cohorts and by focusing on

the pre-student teaching field experience courses. Also, analysis of syllabi over time for the field experience courses will be used. Further, the level of participation of each student in the moderated chat rooms will be monitored. Lastly, focus group information will provide another way of doing evaluation.

Objective 1

Improve pre-student teaching observations. Using only the pre-service teacher cohorts and focusing on the pre-student teaching field experience courses, we will be able to do the evaluation. Also, analysis of syllabi over time for the field experience courses will be used.

Objective 2

Provide a broader range of field experiences. Analysis of syllabi will be used for this objective along with information provided by focus groups.

Objective 3

Establish web-based services to support the pre-student teaching experience. The participation level of each student in moderated chat rooms will be monitored. Focus group information will provide another way of doing evaluation.

Goal 3 - Overview

Provide a variety of professional support opportunities for faculty and pre-service teachers. These will provide opportunities for peer mentoring and the exchange of ideas and experiences in the effective use of IT in a variety of settings and subjects. To evaluate this goal we will find and possibly modify or develop questionnaires to collect factual participation information and surveys to assess the quality of participation. Finally, the information from the focus groups will assist in the evaluation of this goal.

Objective 1

Develop technology-based teaching circles for pre-service teachers, cooperating teachers and teacher education faculty. Basic record keeping will provide information for the evaluation of this objective. Also, focus group data will be used.

Objective 2

Provide technical support services for faculty and pre-service teachers. Help logs and simple open-ended user evaluation forms will be kept by the instructional technology assistance facility staff and analyzed for evaluation purposes.

Goal 4 - Overview

Enhance the technological infrastructure of the consortium members to better support the project initiatives to evaluate this goal an approach similar to the evaluation of Goal 3 will be used. We will find and possibly modify or develop questionnaires to collect factual participation information and surveys to assess the quality of participation. Further, basic university administration record keeping will be used for evaluation. To finish the evaluation of this goal, information from the focus groups will be used in the evaluation.

Objective 1

Provide modern computing laboratories for pre-service teachers including multi-media capability. The use of logs and simple open-ended user evaluation forms will be kept by the instructional technology assistance facility staff and analyzed for evaluation purposes. Focus group feedback will also be employed.

Objective 2

Develop campus networks that provide students access to modern network technology and that facilitate collaborative work. Simple university administrative record keeping will provide the necessary information.

Objective 3

Implement programs to assure faculty in the teacher preparation program and related subject areas have adequate computers. Simple university administrative record keeping will provide the necessary information. . Focus group feedback will also be employed.

Objective 4

Have teacher preparation faculty actively involved in technology planning. Simple university administrative record keeping will provide the necessary information. Focus group feedback will also be employed.

Summary

The purpose of this paper is to present an evaluation plan for this kind of project. This plan is only the beginnings of a total evaluation. Comment and suggestions will be greatly appreciated.

Using the Course Management System Blackboard 5 with the Computer Algebra System Maple in the Mathematics Classroom

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Putting Mathematics on the Web has become a challenge to say the least. There exist clever applets, "keyboard translations" of mathematical symbols, along with charts of symbols that are available for use as gifs. These methods of putting this discipline on the internet are cumbersome and disjointed. They are simply not user friendly. For mathematics professors whose interests are in mathematics and the teaching of mathematics, the technology has not caught up with the specific needs.

Independent of the web, there are powerful computer algebra systems available that are available for research in mathematics and for the teaching of mathematics. Maple is such a computer algebra system. It is a powerful tool with which to explore, hypothesize visualize and compute. For us, it has a great influence in the mathematics classroom. Students are able to solve realistic problems that were beyond the scope of the course simply because they could not be done by hand or calculator. The use of the computer in the mathematics classroom has evolved from checking the validity of hand calculations to doing difficult calculations and then to visualization and animation of two and three-dimensional graphs. Topics like Riemann sums, linear transformations and Maclaurin series have come alive in animated graphics. After spending some years capitalizing on the potential of the computer algebra system, the web was our next logical step. It was another tool. However, we learned two major things from our experience with Maple. First, avoid the cookbook approach (press this key or type this code etc.). Second, do not use the technology for the sake of using it but rather use it only to further your pedagogical goals. The Internet is a technological tool with the emphasis on the word "tool." We should utilize the web but the student should not be aware that he/she is even using the tool. The student should be concentrating on learning or transporting the mathematics. The student does not consciously think about the pencil and notebook. Similarly, the student should expend little conscious effort in using the technological tool. The professor should also be able to reap the benefits of the web without an inordinate amount of work.

We first began to use technology in the classroom in an organized fashion when the computer algebra system Maple was introduced into our calculus classrooms in 1992. We have learned from the mistakes we made when we introduced Maple to our students. So when approaching the use of the Internet, we started with the question: "How can the web help us in the teaching of mathematics?" rather than "How can we integrate the web into our courses?" With the limitations of the web with mathematical symbols, the answer was not clear. We were already using a powerful tool – the computer algebra system and we had no desire to abandon that tool and start writing java applets so as to "get the mathematics on the web." We wanted to use the vehicle of the Internet but we did not want to have to redesign its chassis so as to enable it to carry our mathematics. We wanted to just hop in it and drive.

In the end what we did was marry the classroom management system Blackboard with the Maple. Forgive the analogy but we figured out how to adapt the generic school bus to transport o mathematics so as not to allow the power of Maple to be lost. This method does have its limitations. We sacrificed the real-time interaction for the power of Maple and the ease of use. In our courses now we have added an Internet component. The student is able to view Maple worksheets with or without animation in a very simple manner with nothing else but a current browser. The student is able to discuss mathematics with other students through a discussion thread. The professor and the student can exchange maple worksheets via the drop box open and then open them up in Maple for manipulation (in this case the student does need to have Maple on his/her machine).

One can create a web page and incorporate many technological features. We chose a classroom management system as our vehicle rather than using our own web pages. We did this to help us get started on the web with a minimum amount of web programming. We think that this is an efficient vehicle for those who want to invest their time in learning how to use the Internet in a sound pedagogical manner. Also we wanted to extend the experience we had in Maple into the online environment. The course management system Blackboard allows us to do this with a minimal amount of web programming skills. While our experience has been with these course management systems, other course management systems have similar properties.

The most important lesson we learned from our Maple experience is that in a mathematics classroom, mathematical ideas must be the driving force behind every use of technology. Technology can certainly make solving problems easier. More importantly, previously unsolvable problems might actually be solved. The

graphical capabilities can make mathematical ideas easier to comprehend. But we have to control our enthusiasm. We have to learn from our mistakes. For example, our first Maple labs were overly ambitious. They typically covered too much material and required too much code. We discovered that an overabundance of syntax leads to less comprehension. We decided that "keeping it simple" in terms of the technological tool while challenging the students' mathematical ability was the best way to use any tool. As we began to use the Internet in our classes, we kept these lessons in mind.

We propose to introduce the course management system Blackboard 5 at our session. This software allows faculty members to put course material online. For example, assignments can be created and updated, a grade book can be created, or students can participate in an online discussion. Specifically, our presentation would include:

- Announcements
- Tasks
  - Uploading and downloading documents
  - Uploading Maple HTML files for viewing
  - Uploading and downloading Maple mws files for manipulation
- Grades
  - Creating a gradebook
  - Exporting grades to Excel
- Links
- Forums
  - Creating a new thread
  - Managing a new thread

When using a class management system there are several overriding principles that will make the transition to cyberspace easier. To begin, have a vision of your overall hierarchy before trying to create a new course with a course management system. When you start to create your course, have your syllabus completed. This helps you organize the course into headings and subheadings. From the outset, be specific about your expectations. Explain your grading system thoroughly. If you have an online component, then you should tell the students how many times per week that you expect them to participate. If you post a discussion question, and you expect that students respond to each other's comments, then you should tell them if a statement like "I agree with Nancy" counts as a comment. That is, be specific about your expectations concerning the content of these comments.

Familiarize the students with any online component in a non-threatening way. Give the students a few days to familiarize themselves with this new environment and with each other. Sometimes this can be accomplished by giving an assignment that has little or no credit attached to it. You can begin to establish a classroom community online by asking students to tell the class something about themselves. If you decide to do this, you can set the tone for the rest of the class by being the first one to respond. Let your personality shine through. Give the students the type of response that you would like to receive.

It is extremely important to be specific about your expectations concerning Internet etiquette. If you expect students to use proper grammar, tell them. It may be a mistake to let students post responses anonymously. Students should be held as responsible for their comments online as they would be for their comments in a classroom setting. Blackboard gives the professor the choice to allow anonymous posting or not to allow it. Consider the academic integrity of the classroom when making that decision.

Respond to students' questions in a timely fashion. Whenever possible, use students' names. Questions about class material should be posted to the discussion and shared with the class rather than sent to the teacher by email. Everyone should benefit from the questions of others. Be strict about this policy. If you start to respond to individual questions via email, you can easily get overwhelmed. There is simply not enough time to respond to individual questions. You will find yourself repeating the answers that you have already given to another individual.

Be timely. For example, if you tell your classes that an assignment will be available at a certain time, be sure it is posted by that time. If your course has a traditional classroom component and an online component, realize that any new information published online can have unexpected ramifications. For example, if you post the grades of a test that is being returned to the student the next day, your actions can affect tomorrow's attendance.

If you have an online grade book, keep it up to date. If you have changed a student's grade, change it online too. Expect students to point out any error you have made online. Don't get impatient if they remind you about a mistake that you have not changed. Encourage them to remind you if the error has not been corrected within two or three days. If you have an online grade book, make sure that your grading system has been clearly explained. This will minimize confusion about how the final grade will be calculated.

Incorporating Maple into the classroom management system brings some complications. Users must be aware that browsers have a significant effect on what students see on the screen. Also, students must be aware that if they want to manipulate downloaded Maple worksheets, they have to have Maple on their machines. Putting mathematics on the Web is particularly difficult because of the limitations concerning manipulation of mathematical symbols. We have used the capabilities of Maple to "transport" our mathematics. There are two ways to do this.

First, it is possible to view a Maple worksheet as an html file in Blackboard. The student will be able to view the worksheet, but will not be able to interact with the worksheet. Even animations can be viewed using this method. This can be accomplished in the following way in Version V. When the Maple worksheet is completed, you can choose the options:

File Export As HTML

You then give the file a name. Suppose you give the file the name Animation. This automatically creates three HTML files:

Animation.HTML
Animation1.HTML
AnimationTOC.HTML

If you want to put this Maple worksheet online in Blackboard, attach the file Animation1.HTML to an item under course assignments or projects, etc. When you try to submit this you will be given the message that there are missing images. The names of these images will be provided. You will have to use the browser option to find these images in the images subdirectory. You can then submit this item.

Second, the student can download a Maple worksheet as an mws file and open it in Maple. This is more powerful than the first method because now the student can manipulate and run the Maple worksheet. This is where you may encounter various problems with the browser. Depending on the type of browser, the version of the browser, or the settings of the browser, different computers will display different screens. We have decided to rely on a rather generic way of downloading worksheets. Once the Maple mws file is pointed to via an external link or the drop box option in Blackboard, the student can right click on the link and save the file on the C or A drive. The student can then open the file in Maple. Some computers will open up the Maple worksheet automatically when the student left clicks but many will not. In either case, Maple must be on the student's machine or network. Maple is not being downloaded, only the worksheet is.

Throughout the presentation, we will illustrate some of the difficulties we found while using this software and we will make suggestions as to how we managed to circumvent these problems. We will also discuss the very difficult problem associated with trying to communicate electronically in the language of mathematics. Although the present technology does not support interactive Maple worksheets, we will demonstrate how to upload Maple worksheets into Blackboard courses. The students will be able to view the worksheets and their output, including animation. We will not require previous knowledge of Maple, or of HTML. We are also assuming that this presentation is for people who have not used Blackboard.

Breaking Down the Walls in Teacher Education Programs

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Abstract: Is your teacher preparation "program" really a team of education faculty, content faculty, and K-12 teachers? These groups face the same doubts, promises, and problems related to technology integration. Rather than a frontal assault on teaching technology usage to them, "Project Jericho: Breaking Down the Walls" took a back door approach, getting these groups talking, sharing, and cooperating with regards to technology. Results include professional development and program changes. English/Language Arts, Science, Math, and Social Studies Innovation Teams of nine K-12 teachers, three teacher educators, and three content faculty match up technology skills with state-mandated curriculum, then develop technology-rich units for integration in all parts of teacher preparation. Innovation Teams share on-line and meet monthly to analyze standards, develop a curriculum/technology matrix, work on lesson plans, and work in triads exploring and analyzing websites, lesson plans, and collaborations. Team members share and implement Innovation Team ideas and suggestions.

Technology Integration: A Collaborative Model

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Abstract: The College of Education at California State University, Sacramento designed and implemented a collaborative model for technology integration. The teacher preparation program in conjunction with its school district partners redesigned existing curricula and field placements by simultaneously implementing technology-based lessons into preservice teacher education coursework and K-8 classrooms. These lessons were designed by participants who included teacher education methods faculty, K-8 collaborative teachers, and classroom teachers trained in technology integration. Design teams were formed around content areas and consisted of one university faculty, one classroom technology mentor, and two collaborative teachers from partnership districts. By designing teams around content areas, each course in the preservice program contained a significant unit in which every student teacher participated.

Introduction

The College of Education at California State University, Sacramento (CSUS) in collaboration with the Roseville (CA) City School District developed and implemented a collaborative model for simultaneous integration of technology in preservice coursework and K-8 field placement classrooms. This year long project was aimed at accomplishing the following objectives: 1) testing a model for generating technology-infused curricula which utilized technology leadership within a partner school district; 2) increasing the capacity of CSUS faculty and partnership teachers to integrate technology into their respective classrooms occurred, 3) increasing strong research based skills by student teachers for how technology can be integrated across the curriculum and grade levels. In this paper, we describe the project, its accomplishments and dilemmas, and draw lessons for subsequent improvements in technology use within our teacher preparation programs.

Teacher Preparation at CSUS

The California State University, Sacramento College of Education is one of the largest teacher preparation programs within the California State University System. Last year it granted nearly 700 preliminary credentials to elementary, secondary, and special education teachers. The credential program is a three semester, Fifth year post baccalaureate program.

The College of Education structures its credential program into geographic "Centers" grouping preservice teachers into cohorts of twenty-five to thirty. A Center works within specified local public school districts. Half of the teacher preparation consists of field work (student teaching) that takes place

within these districts. The resulting well-developed partnerships with cadres of K-8 field mentor teachers lead to outstanding field placements for student teachers

The Roseville City School District is a member of the Placer County Teacher Preparation Center. Student teachers' field placements are with Collaborative Teachers. A Collaborative Teacher (CT) is an exceptional classroom teacher who serves in place of traditional university supervisors and receives university stipends and training in student teacher supervision. CTs in a Center also have more responsibility in designing and implementing the teacher education program (e.g. co-teaching methods classes).

The Roseville City School District has a strong commitment to the integration of technology and curriculum. Its technology plan, with its underlying philosophical commitment to collaboration, includes a robust technology integration training model for classroom teachers. These classroom teachers bring their curriculum expertise to the newest technology and develop meaningful ways to blend the two. Much of the technology leader training has been based upon Apple Classrooms of Tomorrow (ACOT) methodologies. This training is designed around a Unit of Practice (UOP), a specific process for thinking about and developing a classroom activity. Participants explored technology in the context of working through a sample UOP. Then using one of their own lessons, they developed an original UOP that incorporated technology in a fundamental way. In so doing, the curriculum remains rigorous and technology is not an end in and of itself. This model, of starting with the curriculum and infusing the technology, served as a springboard for this project.

The College of Education has a technology plan that puts much emphasis on the active learning of the student. This plan was in the initial stages of implementation during the course of this project. Recently, the College of Education was mandated by the California Commission on Teacher Credentialing to integrate technology into all of its methods courses. Newly developed statewide standards set criteria for teacher preparation programs. CSUS grouped these standards into three categories: admission requirements, technology skills and integration into curriculum. Admission standards require applicants to demonstrate the ability to use email and search the Internet. Additionally, technology modules are available for student teachers that need basic technology skill training. A third group of standards demand that technology be integrated into preservice coursework. Upon completion of the teacher preparation program, it is expected that all students meet exit criteria for technology based upon the standards. However, to do this in the isolation of a college classroom without coinciding practicum experience in a K-8 classroom results in little long-term capacity of new teachers to continue to use technology. This capacity building project allowed this to be done on two levels: in methods and foundations courses and simultaneously implemented within field placement classrooms.

Model

At the core of this project was the development of design teams. Four design teams were assembled. Each team consisted of one CSUS faculty, one classroom technology mentor teacher, and two Collaborative Teachers. The CSUS faculty was to include one from each content methods area: mathematics, science, reading/language arts, social studies, as well as educational foundations. However, due to scheduling conflicts, reading/language arts faculty was not involved during the academic year project. The five classroom technology mentor teachers were selected from the school district's first cadre of teachers trained in technology integration. These reflected a balance of grade levels and content emphases. Ten Collaborative Teachers from throughout the Center were selected from the pool of experienced field mentors.

College of Education faculty may have the content or pedagogical background while the Collaborative Teacher may have the pragmatic know-how of what really works in an elementary or middle school classroom, and the technology mentor teacher provided the expertise of having been through a similar implementation process previously. This mix provided for powerful and collaborative design teams.

The design teams were to develop two products over the course of the project. The first were K-8 lessons/units that would be posted on district and college websites for use by current classroom teachers and university preservice methods faculty and students. Design teams used model Units of Practice provided by the technology mentor teachers as the basis of their initial work. They also learned how to use

rubric criteria to evaluate their lessons. The second product was a redesign of preservice coursework integrating technology into each methods and foundation course.

Timeline

In early fall, design teams were formed around content areas. For example, a fourth grade technology mentor teacher who previously developed a UOP infusing technology into a social studies unit was teamed with the social studies methods faculty and two upper grade CTs. Therefore, this team was expected to develop a social studies unit. By designing teams around content areas, each course in the preservice program would have a significant unit in which every student teacher would participate.

At the initial meeting, the technology trainers facilitated each of the teams working from their expertise in blending technology and curriculum. They shared the UOPs that they previously developed and implemented in their K-8 classrooms. These exemplary units set the standard for the units that the teams were setting out to develop. The lessons in the shared units served as the springboard to connect skills, assessment, content, problem solving, research and standards which needed to be components of the redesigned curriculum.

The teams also reviewed district and college technology plans as well as state and national technology standards upon which much of the work needed to be built. Each participant also took the "Profiler" self-assessment so that the participants could record individual growth.

Throughout the fall semester, teams developed their first integrated lessons and communicated with one another in a variety of ways including listserv and email. As the semester progressed, teams continued to meet amongst themselves to develop their own lessons. The entire project group met every 6 weeks during which time each team shared their work in progress, and specific skills were taught to the participants per participant request. Additionally rubric scoring of the units was done at these meetings. The rubric is available on line at < http://www.classroom.com/edsoasis/>. Due to the variety of skills within each design team, team members assisted one another at their meetings much more than at the whole project meetings.

By the end of fall semester the first lessons were to have been developed and implemented in the K-8 classrooms of the CTs and preservice courses. These completed lessons were implemented in a variety of ways during the spring semester university coursework and in the CT classrooms.

During the spring semester, every student teacher encountered technology-based lessons in their Placer County Center coursework, with the exception of literacy courses. Built into the coursework was a component that had each of the student teachers teaching, planning, and/or observing and evaluating a technology based lesson. For example, as part of the final course project in elementary mathematics methods, the preservice students were to develop a lesson that integrated technology. Additionally, each design team was given an overhead presentation system for use among the team members when their newly designed lessons were taught.

The preservice faculty integrated technology in a variety of ways. For example, in educational foundations, an area in which some of the faculty had difficulty envisioning how technology integration could occur, preservice teachers did webquests based upon Howard Gardner's Theory of Multiple Intelligences. The educational foundations faculty designed an assignment in collaboration with her design team teachers in which the preservice teachers observed their classrooms and evaluated whether or not specific examples of the use of computers in teaching were appropriate or effective. The preservice teachers spent time over the course of two days observing elementary teachers (who were design team member) utilizing computers in the classroom. The documented data was to refer to both the multiple intelligences and effective lesson design with technology. The students were encouraged to refer to the project's rubric. The instructor worked very closely with the classroom teachers in obtaining permission to videotape these lessons and to establish schedules that would work well for all involved parties.

In Science methods, the course now included a means by which students could do some of their coursework on-line and each preservice teacher developed a webquest for a specific science concept for use in their student teaching placements. In mathematics methods, the student teachers learned how to develop algebraic thinking using spreadsheets with students in grades K-8. The student teachers also analyzed a variety of mathematics-related websites: some for teacher use and some for student use. The mathematics design team unit was "Creating a Playground." As the semester progressed, the unit was presented to the preservice students for participation, analysis and evaluation.

Outcomes

The integrated design teams allowed all participants to expand technology use in their respective teaching. As the social studies methods faculty stated,

> "As a result of being involved in this project several observations can be made. First, students have begun talking about how to integrate technology with instruction. I have made it a requirement for students to document at least one lesson that integrates technology and instruction. This was done in addition to going to the partner district's Technology Learning Center; so, in effect, the time allotted to technology integration was expanded this semester. Third, and possible, the most exciting, another member of my design team and I have discussed his coming to The Technology Learning Center and demonstrating His own use of technology in his social studies classes. I asked a student teacher what she thought about this idea. Her reply was, "I think it would be great!"

Clearly one of the strongest outcomes of the design team model was the development of relationships between university faculty and classroom teachers. Here is how one of the technology mentor teachers described the results of this joint, collaborative work:

> " The project has pushed me to explore how to use the Internet with my students. Previously the focus of my teaching revolved around teaching students how to acquire information from the Internet. This year, the focus has been more on teaching them how to transform that information or how to use the information to construct new knowledge. This especially happened with my "Gifted and Talented" students when I asked them to select a topic in history that has changed us. I required that they find primary sources such as documents, journals, pictures, maps timelines and statistics. With the information gathered, I wanted them to analyze and evaluate its validity, and then use that information to draw their conclusions about the topic's impact on history. In other words, I focused a lot on instructing my students how to think and evaluate material found on the Internet. I learned a lot about how I taught the process and ways to improve my approach.
>
> I also read more technology articles. I wanted to explore other people's philosophy about using technology to teach... From my readings, I created two Internet activities/lessons that I feel good about. I wanted to see how the Internet could provide music and visuals to enhance a lesson. I created a lesson on Civil War music, focusing on the songs of the Underground Railroad. Another lesson for 7th grade dealt with comparing art from the Classical period, the Middle Ages, and the Renaissance period. I really liked that lesson. The presentation system/projector from the project is a real blessing that encouraged me to design those lessons."

A Collaborative Teacher participant wrote,

"When I started with the project I really didn't know
what to expect. I thought we were going to be looking
at technology and find ways to get student teachers to
use it in their new classrooms. I was pleasantly surprised
when I found out we were going to be putting together
whole units for the teachers to use. It was really exciting
to work with fellow teachers from other districts on
a subject that was interesting to me."

The design team model propelled much of the project. This collaborative process was instrumental in the development and implementation of technology-infused lessons and strengthened partnerships for all participants. Teams were self-selected and curriculum chosen by each team. This resulted in a variety of technology-infused lessons and units. Each team chose different times and places to work and develop their units. This occurred with the development of the curriculum and with the implementation.

Summary of Lessons Learned

This was a project that intended to build the capacity of the preservice program partners to infuse technology into coursework and fieldwork. In looking back at the evaluative data and our collective experiences, we have learned the following lessons that will guide the next phase of the Teacher Preparation Program technology components.

Lesson 1: It is possible to build effective partnerships between K-8 and university faculty for technology infusion into teacher preparation and K-8 classrooms. Arts and Sciences participation was minimal as partnerships here are just building, but are anticipated for the future to help develop additional content expertise for the K-8 classroom.

Lesson 2: Leadership for such collaborations can come from the classroom side as well as the university side. What is not yet clear is whether the reversal of the usual hierarchy of leadership could take place without the pre-existing university partnership already existing within the district.

Lesson 3: The design team approach worked will in producing lessons that were implemented in K-8 and teacher education. Strong collaborative relationships were a result of this project. What would have strengthened the design team model was more on-line communication at predetermined times when all members were on –line simultaneously.

Lesson 4: Faculty were more resistant to putting their lessons on the public website than were the classroom teachers. Perhaps this was due in part to the newness of the technology for many faculty members and a reluctance to expose the products of their initial attempts at technology infusion.

Lesson 5: Student teachers were able to focus simultaneously on the quality of technology in the lessons, following the rubric, and on the curriculum. This piece is important because it demonstrated that the technology was not so overwhelming to students that they could not attend to the curricular design elements.

Lesson 6: This preliminary work identified how we need to build future evaluation strategies to create strong formative feedback for lesson and program development.

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Models, Mentors, and Mobility in the Teacher Education Program

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Abstract: This paper is a report on the activities of a PT^3 implementation grant, Project M^3: Models, Mentors, and Mobility. Project M^3 has three major goals: 1) To identify and develop model practitioners and models of practice for teacher education students, 2) To develop a network of mentors to support and train students, faculty, and partner school teachers, and 3) To utilize laptop computers, personal digital assistants, and online support and instruction to improve student access to technology.

Project M^3 reaches out to the university community, private and public schools, and private businesses to maintain a network of models and mentors and to support integration of technology in the college classroom and partner schools. Project M^3 also uses new advances in mobile computing to improve accessibility to technology by creating and modeling the use of wireless laptops and personal digital assistants in the classrooms in the College of Education and in PreK-12 schools. On-line instruction and support are also used to provide better access to learning experiences, training, and support.

Introduction

In the last decade, school districts in the United States have invested billions of local, state, and federal dollars to equip schools with computers and advanced telecommunications equipment. During this same time period, higher education institutions have scrambled to advance their own technology infrastructures. Unfortunately, technological advancement in higher education has proceeded unevenly in many instances, with Colleges of Education (COE) hard-pressed to match the resource bases of such Colleges or Schools as Medicine, Engineering, or Business (National Council for Accreditation of Teacher Education, NCATE, 1998). Even when resources are available in COEs and schools, it is not necessarily the case that the technology is used. This is often the result of untrained faculty and in some instances due to inadequacies in infrastructure (e.g., poor wiring).

The number of schools in the United States having access to the Internet has increased from 35% in 1994 to 89% in 1998 (National Center for Education Statistics, 1999), while classroom teachers in the United States are "least likely to report being very well prepared for activities...integrating educational technology into the grade or subject taught" (NCES, 1999, p. 74).

Wichita Public Schools and Wichita State University's College of Education (COE), generally, have reflected the national trends. Both have some technology, but few trained faculty and limited vision of how technology can be integrated into the curriculum. Both desire to address these issues.

Work in local PreK-12 schools involving technology has progressed steadily in recent years. All schools are connected to the district network. Partner schools for this grant have at least one network/Internet connected computer in each classroom. In their 5-year technology plans, the partner schools have as their goal to integrate technology into their curriculum. Wichita Public Schools are in the process of submitting a bond issue to the public. Electrical wiring is a key component of the infrastructure needs requested.

In the WSU College of Education, early technology efforts resulted in personal computers for each faculty member and a COE 20-station computer lab. Within the past two years the college has focused efforts on increasing the technology access and skills of faculty, staff, and students. As part of this effort, the college completed some major technology initiatives including (a) the development of a technology mission, vision, and commitments document that incorporates recent International Society for Technology in Education Standards (ISTE, 2000) and current and draft standards of the National Council for Accreditation of Teacher Education (NCATE, 1998); (b) completion of three technology needs assessments conducted both by the College of Education and the university, that yielded consistent results; and (c) the development and implementation of a one-year U. S. Department of Education Capacity Building grant, Expanding Curriculum Integration through Technology Education (EXCITE). All have produced forward technology movement in the college.

The needs assessments in the COE indicated that the faculty and staff are self-taught technology users who are quite comfortable with the basics of word processing and e-mail but who do not use technology to any great extent in their classroom teaching. Significantly, it was also apparent that faculty did not expect students to use technology in meaningful ways. However when asked, over 50% of the faculty identified 18 different technologies that they felt had either "somewhat high" or "high" potential for instructional impact.

Even more recently, a partner in Project M^3, the Wichita State University Center for Teaching and Research Excellence, found similar results in an assessment of technology needs of WSU faculty. The Center's assessment made it clear that faculty, university-wide, desire support to add technology resources to their courses.

Finally, a self-assessment of University and College of Education technology readiness, using STaR Chart: A Self-Assessment Tool for Colleges of Education (CEO Forum, 2000) also indicated a need for future technology training for COE faculty. The STaR Chart revealed a composite picture of a university and COE operating in the "Early" and "Developing" levels of readiness but anxious and excited about locating and implementing resources to move to the two higher levels of readiness, "Advanced" and "Target".

During this time, a vision, mission, and goals statement was developed to guide efforts along with the needs assessments. This document states, "The vision for the College of Education at Wichita State University is a technologically astute academic culture… in which students, faculty, staff, alumni, and the community work together … to enhance learning through modeling and integration of appropriate technologies" (College of Education, 1999).

As a result of a capacity grant, the COE was able to provide professional development for faculty and partner school teachers in on-line instruction, presentation software, multimedia and Internet in the classroom, video-editing, and curriculum integration. These efforts focused faculty members' attention on the impact technology integration can have on student and faculty performance. The increased awareness and skill level has resulted in a rising number of class activities using technology. Faculty began to request the computer lab for class sessions more frequently, and student use of open lab hours increased dramatically. These changes resulted in further increases of requests for technical and instruction support. The computer lab schedule and check out of equipment became more complicated as usage increased. It became apparent that the COE's successes in raising the awareness level and adoption level of technology had created the need for more support and better access to the technology. An additional need surfaced as the COE looked for exemplary models of technology integration in field placements. Schools used for field placements were not always those at the forefront of technology integration.

The primary purpose of Project M^3: Models, Mentors, and Mobility is to provide better access to technology in classrooms for teacher education students and to increase the number of exemplary models for students. To reach our goals, Project M^3 developed three sets of activities that encourage and support teacher education faculty and students to integrate technology.

Models of Practice

Project M^3 has its first element, Models. Models has two parts: (1) Teachers who model effective use of instruction in their classrooms (model practitioners), and (2) Technology Integration Projects for Students (TIPS) that are designed to be used as models for other teachers who might be struggling to find ways to integrate technology. In an attempt to prepare teachers who model effective use of instruction, WSU has taken a constructivist approach. ATE Standards for Teacher Educators (http://www.siu.edu/departments/coe/ate/atestand.html) require that master teacher educators model professional teaching practices that reflect best available practices in teacher education (Standard 1), systematically reflect on their own practice (Standard 3) and provide leadership in evaluating programs for preservice teachers (Standard 4). Included in the indicators is "regularly revise courses taught to incorporate recent materials, including technology." Teacher educators have an obligation first to model appropriate instructional strategies for the preservice teachers they train, in order that students can participate in activities that they later will use instructing their own students. To this end, our university has attempted to support faculty in their acquisition of needed knowledge and skills as they integrate technology into their coursework.

The integration of technology standards into the teacher education program required breaking the standards into bits and methodically conferencing with individual faculty to see what they were modeling for and requiring of students. Following these initial information-gathering sessions, the curriculum resource specialist and the technology specialist conferenced with individual faculty members where the "relationship between the instructor and the students is one of cognitive apprenticeship, in which the instructor models problem solving, engineers learning experiences, provides scaffolding as students attempt tasks, and encourages reflection." (Bednar & Charles, 1999, p. 1). We worked as a team to examine the course requirements and as "consultants" offered suggestions of ways technology could support these activities. Faculty were left to make decisions about what was best for them and for their students. After a semester's implementation, elements of satisfaction are examined and refinements made. Those activities that are successful become part of a website designed to disseminate Technology Integration Projects for Teacher Education Students (TIPS for Teacher Education) to others for their modification and/or use. In addition systemic change is being made to the Teacher Education program document.

One major project with partner schools involves designing technology integration projects for elementary students that are tied to new text adoptions. The first project, Technology Integration Projects for Students (TIPS) for Science, completed summer 2000, again used an approach which allowed grade level teams of practicing teachers and preservice teacher education students to begin with what they knew and conference with technology and curriculum experts who could guide them to ways technology could support instruction. The resulting website provided two separate sites, one for students and the other for parents and teachers. The student site provides a science activity "card" designed as a technology-based research, analysis, or communication activity to supplement hands-on activities provided in the classroom. Student outcomes and technology used introduce the page and direct links to teacher-reviewed websites are included on the "cards." The parent/teacher page provided connections to district science standards, ISTE NETS standards for students, district benchmarks, and instructions for teachers where additional preparation was needed. As teachers use these TIPS, WSU plans to showcase teachers teaching with technology and student projects developed with technology. (See http://education.twsu.edu/m3/tips/index.htm.)

Mentors

The Mentors component of M^3 involves coordinating the development of a broad-based network of mentors who will provide training and support for teacher education faculty, LAS and Fine Arts faculty, K-12 partner schools, and pre-service teachers. Professional development activities for faculty and student mentors have been supported by EXCITE, a 1999-2000 Capacity Building grant, also part of the PT3 initiative, the university Center for Excellence in Teaching and Research, the college, partners, and M^3. The outgrowth of EXCITE was that faculty increased their skills and comfort level in order to model the use of technology in their classes. As icing on the cake, faculty are now seen mentoring each other and students

on technology that they now can use, growing more fearless as time passes and experience is gained. The primary projects for this grant include (a) training of preservice teacher education students as student mentors who work with faculty and partner schools on specific projects (b) identifying and collaborating with businesses in the community.

Student mentors have assisted faculty in media development, presentations, on-line instruction, and "wellness clinics" for desktop computers. Faculty members have requested mentor help in learning how to use a digital camera, video editing, developing Web pages, scanning, and researching and developing graphics. Cooperation and collaboration between faculty has also increased as faculty members develop recognition for their use of technology. One new faculty member became excited about offering her educational psychology course on-line and was so successful that she caught the interest of another faculty member who had shown no interest in on-line instruction. The two teamed up to develop their on-line course to include on-line assessment and began to work with their textbook publisher to develop support materials.

Mobility

The third goal of Project M^3 is to utilize new technologies that provide better access to technology for students, teachers, and teacher educators. WSU COE faculty are motivated to increase their use of technology in classroom curriculum, but the classrooms that house pre-service teacher education courses, until recently, have had only basic technology such as overhead projectors and video players. A portable electronic lectern was custom-built with a Macintosh G3 equipped with Virtual PC, WWW browsers and Microsoft Office, VCR, speakers, video projector, and overhead camera to be used in seven classrooms. However, because of old wiring in the building, even the faculty who are lucky enough to secure the cart sometimes found that they had blown a fuse and couldn't use any type of electrical technology during their class.

It is our assumption that technology will be better integrated into the curriculum if it is where the students and teachers are, not necessarily where the machines and technology experts are. Recent advances in wireless technology have provided the College opportunities to make technology transportable to any classroom or conference room with a single network connection. During the last year, the COE used funding acquired through a PT^3 Capacity Grant (Project E.X.C.I.T.E.) and a PT^3 Implementation Grant (Project M^3) to acquire two airports and five laptops with wireless network cards to allow faculty to move the technology into their classrooms. Separate funding has increased the number of laptops available for instructional use. Faculty use these laptops for a variety of instructional uses such as searching for data on the Web, group problem solving, evaluating educational software, and on-line discussions.

In addition, Project M^3 purchased mini-laptop labs for a middle school and a high school for the same purpose and has plans to purchase mini-labs for three additional schools. The laptop mini-labs may be checked out by individual teachers to be taken into classrooms where technology had previously been limited and/or absent. Project M^3 personnel monitor and evaluate how the teachers in the partner schools use the min-labs in their classrooms. Faculty members in the College of Education use the laptop mini-labs for Web searches, on-line testing, file sharing, developing instructional materials such as crossword puzzles, and brainstorming activities.

Because of the enthusiastic response to mobile computing on campus and in our partner schools, five HandSpring personal digital assistants (PDA's) have recently been purchased for use in classrooms. Physical Education student teachers are currently using PDA's for evaluation and assessment in the field. Faculty interest in handheld computing was strong enough that the grant recently organized a university-wide user group to explore instructional uses.

A grant kickoff highlighted our new wireless capabilities in 10 different subject areas. The kickoff demonstrated the old (slide-rules, tables of numbers, antique texts and globes) right beside the new (computers, software, visual imaging Web sites, robotics). Guests from University Computing, Media Resources, Liberal Arts, partner schools, and university administration were impressed with the technology displayed and we have received numerous requests for follow-up demonstrations from public schools and biology, engineering, and business faculty at WSU. The interest in laptops and PDA's has resulted in expansion of the M^3 Web site to include a section on purchasing, configuring, and integrating mobile technology. (See http://education.wichita.edu/m3/mobility.htm.)

These recent additions to the technology infrastructure allow modeling of technology integration in curriculum and engage the students in experiences that lead to more effective and successful technology integration. With the appropriate models and exposure to technology, students experience a 'hands on' approach to develop the foundational skills and knowledge necessary to appropriately select technology tools for problem solving, research, communication, and collaboration.

Conclusions

With faculty trained, resources available, and creativity unleashed, the process of implementing technology into schools continues. We begin with the conversing and encouraging of faculty to try new things with on-the-spot technology support. As faculty learn more, they seem to want to use technology and to learn more. Second, students and student mentors help faculty implement, reflect, and revise technology activities. At times, faculty learn from their students as the students learn from them. Finally, teacher education faculty make changes in their own behavior and in the teacher education program to assure the continued use of technology in the all schools.

"We are all exploring right now and when you explore new territory, the terrain is always unknown. We are just making it a bit more smooth for those who follow--the second time--and learning to climb the molehills and/or mountains in our way, going around the fallen trees, finding the tunnels, swimming the rivers--all without sinking or crashing in the process" (faculty e-mail, October 5, 2000).

"The road ahead will take us places we've never been before...that's for sure!" (Faculty log entry, June 5, 2000).

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Electronic Portfolios as a Capstone Experience

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Abstract: The teacher education program at the University of Cincinnati has undergone substantial revision over the past seven years. It now is a five-year program culminating in two bachelors degrees, a yearlong load bearing compensated internship, and a portfolio documenting each student's progress during the year. Our students have reported that their experience with technology has been a deficiency in the program. Steps are being undertaken to increase the role of technology both in their teacher education courses and their arts and sciences courses. In order to give the students a higher skill level with technology, students will begin transitioning over to digital portfolios pressed to CD. The portfolio will serve as a means to self-analyze their growth during the year. In addition, the digital portfolio will give the students confidence in their own technology skills and demonstrate to future employers that they have the necessary technology skills.

The University of Cincinnati has in place a five-year baccalaureate teacher education program culminating in a series of degrees including a Bachelors degree in an Arts and Sciences subject area, a Bachelors degree in Education, and, with an optional additional summer of coursework, a Masters degree in Education. A centerpiece of that program is a 5th and final year of paid internship in a school where the student assumes a load bearing responsibility for half day for the entire year and is compensated by the participating school district. There is no traditional student teaching experience. Instead, existing teachers in the schools who have acquired adjunct instructor status through the College of Education mentor these students.

In the course of this program it has become apparent that technology skills among the students in the program varies widely. Some of the students are extremely skilled in the use of technology in their teaching, lesson planning, and overall teaching behaviors. Others come into the programs with less skill and often have deep anxieties toward the use of technology in their teaching. Complicating matters is the uneven experience of the classroom teachers who mentor our students and the lack of appropriate hardware, software, and teaching skills using technology in the schools. Often the personnel in these mentoring schools have little knowledge themselves about how to improve the situation and display a deep lack of knowledge of the content standards and the ISTE standards toward the use of technology at their respective grade levels.

To correct these deficiencies, the College of Education at the University of Cincinnati, in collaboration with the mentoring schools as partners, applied for and has received a PT3 grant to infuse technology throughout its teacher education program and require its students to develop a technology project as part of its capstone experience, just prior to graduating from the program. The faculty in the College of Education Teacher Education program is undergoing training on how to use and infuse

technology in their own subject specific areas. These faculty members are developing technology plans that will explore ways of infusing technology throughout the methods sequence. Our college-based faculty will be paired with school-based faculty in the mentor schools to develop a consistent plan to infuse technology throughout the entire experience.

In addition, the students themselves are expected to create technological solutions to their own teaching in the schools. During the internship year (year five), the students have been required to create a paper portfolio documenting their professional growth through the five years of the program. Typically this portfolio consists of a paper notebook expressing their philosophy of education and teaching, with examples of their work and the work of their own students. The students often include representative examples of their own work (papers, photographs of their own teaching, recommendations from mentors, peer evaluations from their own colleagues, statements of their philosophy of education, and written descriptions of their own teaching style) (Loughran & Corrigan, 1995; Wiedmer, 1998; Darling-Hammond & Snyder, 2000).

There are several problems with a paper style portfolio. First, teaching is a visual medium. If one wants to see how one teaches, they either need to see the person teach in a live format or they need to see a video clip of the person in action. Providing videotapes as part of the portfolio has been very expensive. Furthermore, watching an entire lesson is, at best, intellectually tedious. Video editing equipment has traditionally been too difficult for our students to use to extract small vignettes (3 minute segments). The second problem is that it is so difficult to create even a single paper copy of the portfolio that the candidate is unwilling to leave it for the building principal, department head, or human resource officer to view at their leisure. Since many of our students wish to use the portfolio as a selling tool, they are saddled with the cost of making duplicates of a very expensive document.

Our solution to these problems is for our students to create a digital portfolio that they can duplicate on CD-ROM for under 50 cents a copy (Barrett, 1998; Read & Cafolla, 1999). The digital portfolio includes all of the aspects of the paper portfolio (including sample work, philosophy of teaching, resume, examples of student work) and also includes brief video clips (Barrett, 1998; Read & Cafolla, 1999), in a QuickTime format, of their teaching. This solves several problems. First, the viewer is able to actually watch the individual teach. (All of our interns are videotaped several times during the year.) The vignette can be tied to a standard, or as a demonstration of a philosophy of teaching. For example, if the teacher espouses a Constructivist view of instruction, the implementation of that view in the classroom could be the short video clip in the digital portfolio. Secondly, the cost to reproduce a CD is around 50 cents a copy, plus the cost of the label and jacket. Students can make multiple copies of their portfolio for pennies compared to what it would cost to reproduce a paper portfolio (Weidmer, 1998). Digital portfolios are also more navigable. Searches on portfolios based on a thematic organizational model can yield specific outcomes much more quickly in digital as opposed to paper format (Niguidula, 1997).

An additional benefit is that building principals under pressure to hire technologically competent teachers are more inclined to hire someone who hands them a CD and says, "here, put this in your CD-ROM and learn all about me and my teaching style, oh, and by the way, I created this myself" than someone who simply comes in and discusses what they may do with technology in the classroom (Waugh et al., 1999).

A final benefit of the digital portfolio is that lessons that utilize the technology show very well in this portfolio environment. This makes it more likely that our students will use the technology in their own teaching, recognizing that it will be a better demonstration of their own technological capabilities within the digital portfolio (Niguidula, 1997).

Currently we are developing a model of what these portfolios will look like. Several prototype examples have been created. The technology to scale this into an environment that graduates over 200 teacher education students per year is being scoped and acquired. Over the next three years of our PT3 grant we hope to make significant improvements in the approach and plan to collaborate with other PT3 grantees developing similar approaches.

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Focusing on the Learner: Interactive Environments for University Faculty, Inservice and Preservice Educators

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Abstract: The impact a World Wide Web (Web) site may have on any community may be either of two extremes, integrated into the daily activities or barely tolerated, or somewhere in between. The impact a Web site would have if focused specifically upon university faculty, inservice and preservice teacher educators could be beyond the hopes of the creators; however, the usefulness of the Web site must be extremely user-friendly and directly impact the user's daily experiences.

Introduction

The impact a World Wide Web (Web) site may have on any community may be either of two extremes, integrated into the daily activities or barely tolerated, or somewhere in between. Obviously, the positive impact of a Web site within the community is preferable, which is why the thoughtful design, development, testing and revision of such a site must occur in a considerate, painstaking manner. The impact a Web site would have if focused specifically upon university faculty, inservice and preservice teacher educators could be beyond the hopes of the creators; however, the usefulness of the Web site must be extremely user-friendly and directly impact the user's daily experiences. The design and development of a Web site for a Department of Education Preparing Tomorrow's Teachers to Use Technology three-year grant for the University of Houston – Clear Lake is focused upon the preservice teacher candidate, the inservice teacher and the university faculty; further, this Web site must be developed as a self-sustaining environment.

Interactive Environments

Interactive environments aid a Web site in offering useful elements that may be used on a daily basis. For example, chat rooms and discussion lists that are created for specific schools' use makes available the opportunity for ownership and integration into the preservice teacher educator's, inservice teacher educator's, and university faculty's daily harried schedule. The chat rooms and discussion lists would offer innumerable possibilities, such as virtual chats in which the preservice and inservice teacher educators meet to discuss possibilities for future technology-rich activities. Or perhaps the university faculty members would like to integrate weekly chat sessions with groups of preservice teacher educators who are supported at three separate schools through out two districts on either side of a county; instead of the students driving an hour to meet the university faculty member, an online chat room makes available a virtual meeting place where all meeting members will be available for discussions and opinions. This is just one example of interactive environments that focuses upon the learner.

Numerous interactive elements are integrated into a technologically rich Web site that offers innumerable possibilities to the teacher education community. Interactive environments for university faculty, inservice and preservice teacher educators are imperative towards a successful cooperative experience that focuses the energies and attention on the learner.

Web Site Design Elements

There are numerous elements associated with the design of a Web site. Along with these imperative elements are the desired aspects that are to be included within the Web site. Focusing upon the desired aspects, following is a list of areas that are to be developed within the Web site:

- Schedule of Professional Development Opportunities or Events for First-Semester Teacher Educator Candidates
- Schedule of Professional Development Opportunities or Events for Second-Semester Teacher Educator Candidates
- Technology-Integrated Lesson Plans
- Online Professional Journal
- Online Professional Development Opportunities
- Listserv Area
- Discussion List(s) Area
- Chat Session(s) Area
- Site Navigation Structure
- Background Information of the UHCL Professional Development Opportunities Web Site

Each aspect of this Web site will take on a life of its own, with sub-categories within each developing area. The self-sustaining elements that are imperative towards the fulfillment of the Web site vision are integrated into each area of the Web site. For example, the listserv will have form areas to subscribe, unsubscribe and post messages to the listserv, without the added difficulty of moving between digital environments (such as from an Internet browser to the e-mail environment). A second example would be the Online Professional Journal section, where users may upload their developing manuscript and make it available for all users to review. Once the manuscript is uploaded to the server, the reviewers will have the ability to add their comments to a discussion list that will be available at the bottom of the manuscript's Web page; this offers the manuscript author the ability to obtain relevant feedback from the professional community, as well as offers the professional community the opportunity to discuss evolving theoretical and application-focused manuscripts.

The development environment for this Web site is a Cold Fusion server. The decision to develop this Web site within a Cold Fusion environment was elemental; the design and development team desired a database structure underlying the visual display area, to ensure the seamless integration of information and ease of use. The underlying database structure enables the swift employment of uploaded information within the Web site, without the constant maintenance of a Web site or server administrator. Therefore, the decision to build a Web site around a database structure, specifically Cold Fusion, was an appropriate decision.

Conclusions

The design and development of a Web site creates an environment that impacts the community in either a positive or a deficient manner. The thoughtful inclusion of useful elements within a Web site that is focused specifically upon the needs and desires of preservice teacher education candidates, inservice teacher educators and university faculty can create an interactive environment that focuses upon the learner. Designing interactive environments within the Web site design elements is imperative towards the success of the Web site's inclusion within a learning environment and its sustainability.

Balancing on shifting sands: Teaching in the Information Age

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Abstract: Teachers trying the Internet for the first time can get the feeling that all they've based their career on is suddenly wildly shifting. The growth and development of the Web allows us the vision of a community of learners who are literate in information access and use. Can this vision be accomodated in a classroom environment which embraces student-centered inquiry learning and communication?

Introduction

Teachers trying the Internet for the first time can get the feeling that all they've based their career on is suddenly wildly shifting. As pressure is exerted upon educational systems to implement instructional technologies, teachersÕ abilities to accept change and adopt innovations become key factors for success. The growth and development of the Web allows us the vision of a community of learners who are literate in information access and use. Can this vision be accomodated in a classroom environment which embraces student-centered inquiry learning and communication?

Teachers adopting the Web into their teaching toolkit are presented with a large set of possible teaching techniques. The Web with its elements of text, hyperlinks, graphics, photographs, sound, animation, and video generally allows nonsequential or nonlinear access to the elements providing for flexibility and interactivity (Levin & Matthews, 1997.) With its multimodal presentation, Web-based instruction can be effective for accomodating the needs of different learners in learning cognitive and procedural information (Ayersman, 1996). Computer technology in general has not had the impact expected in the schools because of inadequate preparation of teachers (Dupagne & Krendl, 1992; Ingram, 1994). Will the same findings prevail with the innovation of the Web?

Preliminary research has begun to reveal whether professional development can be designed to help teachers find a starting level with the Web within their comfort zone. There is a wide range of entry points for methodology. Introducing the Web as a teaching and learning tool is an innovation that needs a supportive social environment in order for diffusion to occur. (Rogers 1995). Teaching in a high-tech classroom situation involves risk and loss of control for teachers. This may be explained by MacArthur et al.Õs (1995) findings that an unexpected obstacle to success in implementing technology was that the teachers became competent with computers but were overwhelmed by a fear of their studentsÕ misbehavior. Alleviation of the concerns this loss of control causes may spring from observations of good experiences of peers.

Web Methods

The point of entry for methods for using the Web can start at various levels. A teacher can provide guidance for students by printing a list of websites on paper. A next step might be organizing personal bookmarks and loading them on the students' machines to use. Going further, a Web page with links for students can be made with a template (such as Filamentality, Geocities, or School Notes). Research for students can also be guided by making a Web page with an editor (such as Composer, Dreamweaver, or Front Page) or going even further by building a Web page using html code.

Other methods for using the Web for instruction can include printing material from the Web for display or transparencies, using lesson plans found on Web, or writing lesson plans and putting them on Web. In addition, a teacher may use search websites (such as Google, Dogpile, or Hotbot) to find content or teach students effective methods for search sites. Good teaching about search methods will include teaching students proper Web reference citation style. In addition, design of instruction can include downloading data from Web, submitting data collected by students to a website, students making Web pages for presentations, using the Web as a source for PowerPoint presentations, and downloading images.

Examples of Classroom Practice

Describing examples of classroom practice with the Web may help teachers find a way to bridge from their tried-and-true teaching methods to incorporating new technologies. These can range from online scavenger hunts to virtual field trips to interaction with Java simulations or be as simple as printing Web pages to hang on the bulletin board or use with the overhead. Other examples in use are free student research, guided research as in building a webzine or WebQuest (Dodge 2000), and online quizzes. Communication examples include online discussion boards, cooperative experiments between distant classrooms, and talking to an expert online. This technological environment in classrooms can serve the needs of many types of learners and can be an asset for the teacher willing to approach students as a facilitator (Heller, 1990).

Early Results

Results of workshops taught by the MentorNet project at NC State (Park & Grable 2000) and the Science House (Grable 1999) may serve as an outline for designing workshops for teachers and may suggest further avenues of research. In an exploratory study a group of 50 teachers from three high schools in a rural eastern North Carolina school district were given access to the Web (in classrooms and the media centers), received two days of training with the Web, and were asked to incorporate the Internet in their teaching. The teachers responded to surveys and were observed teaching after six months of computer and Internet availability. When listing the skills and concepts used in teaching on a free response item, 45% of the teachers had used searching in the media center, 5% had made a Web page, and only one teacher had used the Internet in the classroom.

The teaching methods most often used were students searching (14%), downloading data (13%), printing Web pages (13%), finding lesson plans (12%), and teaching the students proper Web citation (10%). The least used methods involved contributing to the Web, i.e. writing Web pages, submitting lesson plans, etc.

The Web activities most often used were research projects, printed Web pages, and online worksheets. The Web activities most often never used were WebQuest, online discussion, and encouraging the students to talk with an expert.

These results indicate that teachers may need more instruction and modeling in areas of Web use where interaction and communication are involved. To encourage more use of the Web in the classroom may involve providing observation opportunities or videos of teachers who are successfully using these techniques. To encourage teachers to produce their own content to contribute to the Web, or to encourage Web page writing by students may mean finding quick and easy page building methods and demonstrating the learning gains possible with these techniques.

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Technology-Rich Education for Tomorrow's Teachers

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Abstract: "Preparing Teachers to Deliver Technology-Rich, Problem-Based Learning Experiences" is a PT3 catalyst grant for the state of Mississippi. The project is a collaboration between the Mississippi Research Consortium members, partner community colleges, and local school districts. The main goal of the project is to infuse technology and hands on science practices in the Mississippi Educational System. This is being accomplished by training elementary education candidates in a technology rich environment. Training is provided to elementary education candidates as well as their faculty and the teachers with whom they complete their field expereince.

Preparing Tomorrow's Teachers

The goal of providing a technology-rich learning environment for elementary education candidates in Mississippi has been accentuated by a grant funded by the U. S. Department of Education. The grant "Preparing Teachers to Deliver Technology-Rich, Problem-Based Learning Experiences" is made possible through the Preparing Tomorrow's Teachers to Use Technology (PT3) Program. The Mississippi Research Consortium, made up of Mississippi State University, Jackson State University, the University of Mississippi, and the University of Southern Mississippi, provided the basis for the promotion of the project.

Consortium Training

Consortium members are providing training for university and community college faculty, mentor elementary (Grades 1-8) schoolteachers and elementary education candidates. Training includes the GLOBE protocols for elementary schools, assistive technology, and training concerning the use of technology in the classroom. The consortium members are collaborating with community colleges and school districts in infusing the technologies.

In an effort to better prepare education professionals for the diverse classroom we are providing opportunities for them to become familiar with the need to address accessibility issues. We have also provided avenues for increasing awareness in addressing these issues.

Elementary Education Candidates

The elementary education candidates are being introduced to the GLOBE (Global Learning and Observations to Benefit the Environment) protocols. Candidates are learning to collect scientifically viable data, how to report them to an international database, and how to use the database to visualize data and to conduct experiments. They are using hands-on activities and technology-rich content in preparing lessons. Working with mentor teachers, they will learn how to implement these techniques in their field placements.

Training for participants in the use of various presentation and productivity software has been initiated. Topics covered include: the use of office products (word processing, spreadsheet...), classroom specific products (grade books, lesson planners...) and research specific products (encyclopedias...). Special training has been conducted in the use of the Internet and other software for teaching. A Project Learning Tree Workshop was held last summer for elementary teachers.

Summary of Accomplishments

- Held workshops for faculty (topics included: Productivity Tools, Adaptive Technology, Internet Resources and Searches, Power Point, WebCT, Arcview GIS, Global Positioning System (GPS and Remote Sensing) and in-service teachers (topics included: Productivity Tools, Adaptive Technology, Internet Resources and Searches, GLOBE, and Project Learning Tree) during the summer.
- Presented topics on Web searches and Adaptive Technology to pre-service classes in March and April.
- Put technology pre survey on the web for use by all 4 sites to collect baseline data for faculty, teachers, and candidate teachers.
- Compiled and submitted IRB for human subjects approval for all 4 sites.
- Coordinated schedule for training pre-service teachers in the fall.
- Presented "GPS and Plastic Recycling" at the Jackson Public School Environmental Learning Center summer camp on July 19, 2000. Graduate assistants helped forty summer camp students (grades 1-10) learn how to use GPS hand Held receivers.
- Collected data on student and teacher technology needs.
- Assembled Teacher Education Council and Faculty support committee (PT3 Advisory Council).

Significance

Over the last several years educators across the Mid South, including Mississippi, have made a concerted effort (a) to develop and disseminate K-12 curriculum guides in mathematics and science that are aligned closely with associated national standards and place heavy emphasis both on the use of constructivist-based, "hands on" and "field-based" (NCATE 1996) learning activities; (b) to look closely at, if not adopt, the new standards for instructional technology proficiency prepared by the International Society for Technology in Education (ISTE 1999), and (c) to allocate hundreds of millions of dollars to facilitate LEA-level development of technology plans and related implementation strategies directed toward ensuring that every school district has the hardware, software, and level of connectivity needed to integrate technology into their K-12 instructional offerings. This focused effort of reform and technology infusion occurring in public schools across the Mid-South is taking place in an educational environment made up of many very poor, rural school districts that are striving to improve the educational offerings of needy students (Stone 1989; The Annie E. Casey Foundation 1997; Mississippi Department of Education 1998). This challenge is further exacerbated by a narrowing field of well-qualified teachers, who have much needed experience in the areas of mathematics, science, and special education (Mississippi Public Education Forum 1998).

While there has been a significant commitment to reforming mathematics and science education in K-12 public schools as well as enhancing the utilization of technology in instruction, no comparable, parallel initiative has been undertaken to ensure that teacher education faculties or the faculties in Arts and Sciences responsible for providing the subject matter expertise to teachers

- Have kept abreast of the significant changes occurring in grades K-12,
- Have acquired the requisite background and skills needed to use the array of new technologies in their own teaching (i.e., to concretely demonstrate how those new technologies can be effectively integrated into their respective subject areas), or
- Modified their teaching strategies to reflect the content, procedural, or technological changes that are occurring.

Thus faculty in Teacher Education and Arts and Sciences are becoming generally unfamiliar with the new technologies and their applications to instruction.

Purpose

With this in mind, the purpose of this project is to strengthen the teacher preparation programs in the partner institutions. The associated goals are: (1 to provide professional development opportunities for both Teacher Education and Arts & Sciences faculties across Mississippi, particularly with regard to the infusion of (a) different technologies, including the array of adaptive technologies available to help serve special needs learners, and (b) an inter-disciplinary, problem-based perspective into the post secondary curricula for which those faculties are responsible, and (2) to initiate a programmatic pre-service teacher preparation effort focused on helping elementary education candidates learn how to effectively create and integrate technology-rich content and to use constructivist-based, "hands on" teaching strategies in mathematics and science.

In order to achieve the preceding purpose, the members of the Mississippi Research Consortium (MRC), and a cooperative alliance among the four major research universities in the State, are serving as the primary partners for the project. This arrangement builds upon existing linkages among consortium members (e.g., their ongoing commitment to having faculty certified as GLOBE trainers who have subsequently been involved in training K-12 teachers to use the environmental education curriculum) and capitalizes on the partners' ongoing efforts to enhance the quality of their respective teacher preparation programs in accordance with Mississippi Department of Education (MDE) guidelines and NCATE standards (NCATE 1996 and 1999). At the same time, the Consortium partners are working to address the State's growing teacher shortage – the four partner institutions prepare almost 90% of the new teachers in Mississippi. Additionally, the overall effort is supported by the State's Commissioner of the Institutions of Higher Learning (IHL). This broad base of support, coupled with the intent of the collaborators to involve as many other teacher-training programs in Mississippi and the surrounding states is seen as increasing the probability that the project will result in sustained changes in pre-service teacher preparation across the IHL system in Mississippi.

As presently envisioned, during the first two years of the project the primary consortium partners are initiating the immersion of lower division potential elementary education candidates in a field based experience that is interdisciplinary, problem-based in nature, involves technology-rich content and learning processes, and affords them multiple opportunities to observe and engage elementary students in an active constructivist-based, "hands on" learning environment.

Conclusion

Acquainting the targeted pre-service candidates, from their very first exposure to an "education" course with concrete applications of different interdisciplinary problems/issues, meaningful and programmatic examples of how to utilize technology to foster learning, techniques for helping to address the unique needs of diverse groups of students, and ways to foster active, "hands-on" learning offers a substantial realm for progressive accomplishments. The Teacher Educators and the Education and the Arts & Sciences Faculties serve to reinforce and expand Education and content area courses.

Overall, the project is contributing to major, systemic improvements in the pre-service teacher preparation programs offered by the cooperating partners. The fact that the four MRC universities prepare roughly 90 % of all the new teachers in Mississippi means that the project will directly impact 500 or more pre-service elementary education candidates per year. When those candidates graduate they will represent between twenty and twenty-five percent of the total number of new teachers entering the State's educator workforce every year. Furthermore, the proposed strategy and associated materials will serve as the foundation for a model that can be replicated more broadly across other teacher preparation programs.

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Technologically Enhanced Cornerstone Courses: A High Impact – Low Cost Approach to Modeling Technology for Pre-service Teachers

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Abstract: This paper reports on the project rationale and design of one initiative to better prepare preservice teachers to integrate technology into their future teaching. This project, technologically enhanced cornerstone courses, brings together teams of teacher educators to redesign large courses taken by most of our preservice teachers. These teams also worked to develop research questions related to the project. By focusing on the large courses taken by most of the preservice teachers the impact of the project is high.

Introduction

Our college of education has a goal to make technology infusion a systemic component of preservice teacher education. Several initiatives have begun in support of this goal. This paper will report on one such initiative, the development of technologically enhanced "cornerstone courses." These courses generally have large sections and are taken by most preservice teachers in our institution. We feel that it is in these courses that we can impact a large number of preservice teachers by modeling effective uses of technology. In addition to the modeling of technology, we are interested in how technology can help develop a more student-centered approach to instruction in large classes.

Project Rationale

The rationale behind this project is two-fold. First, we believe that the modeling of technology integration is key for preservice teachers. There are several opportunities for the teachers to experience the modeling of technology in the classroom. They may see it used in their own K-12 schooling, in the teacher preparation program or in field experiences. We obviously have little control over their own K-12 experience as a student, but we can impact their teacher preparation and field experiences. However, without a concerted effort on the part of the institution as a whole, the experiences will be haphazard. The same course may have one instructor who is well versed in the integration of technology while another may completely avoid its use. This project will focus on modeling technology use in the courses taken by preservice teachers.

The second component of the rationale behind this project is that lasting change must be generated from the bottom up. In other words, mandates about technology use in teacher preparation courses will be much less effective than supporting teams of educators in the development of effective and appropriate technology integration strategies. These teams of educators have a variety of competing demands on their time and energy. Technology integration must work in concert with these demands to make any lasting impact. Beyond the demands of teaching, these educators also have a substantial research commitment. By learning about the interests of these professors, the project facilitators will work to incorporate these interests in meaningful ways through the use of technology.

Project Design

Six courses that are taken by a large number of preservice teachers will be redesigned in three years to incorporate a more learner-centered approach through the use of technology. We refer to these courses as "cornerstone courses" as they are either requirements in the teacher preparation program or are taken by a

large percentage of our preservice teachers. Three courses will be chosen from within the college of education and three will be from other colleges in the same university. The courses within the college were selected based upon the recommendations of the various department chairs in the college. The courses outside the college will be selected through an application and selection process.

One course within the college will be targeted each year. Participants in each cornerstone course project include the project facilitator, a coordinator and course instructors. The role of the facilitator will be to provide technical and pedagogical guidance. The coordinator will be a course instructor who also agrees to be the point person for the project. The hope is that the coordinator will take a lead in encouraging implementation now and in the future. An important goal of the project is to insure the activities are not simply viewed as a one-time occurrence, but rather become a part of the culture of that particular course. The coordinator will also play a key role in identifying the needs of the course and the best way to infuse technology in a way that will increase student centeredness. The course instructors who choose to participate will be involved by implementing the enhancements developed.

Each course identified in the cornerstone project will likely result in a wide variety of approaches. The participants are charged with enhancing the identified course by utilizing technology to increase the student-centeredness of the course. How they go about this is ultimately up to them and again can be guided by their own interests. The facilitator's role is not to dictate the approach but rather to listen to needs and provide suggestions for addressing those needs. Below is a description of how these development activities progressed with the first course targeted, Introduction to Educational Psychology.

The First Cornerstone Course: Introduction to Educational Psychology

This course certainly met the criteria of a cornerstone course by being a required course as well as the fact that the sections are quite large (about 60 students) and getting larger each year. This course was also appealing because of the large number of full-time faculty that regularly teach the course. The large number of faculty would insure that the impact of the project would be broad. One of the first steps in the process was to identify the participants that would be involved in the project. The natural choice for the project coordinator was a professor who had participated in some previous technology integration initiatives and also served as the coordinator of this course for the department. The other participants were recruited from the pool of professors that regularly teach the introductory course. All four of the professors who regularly teach the course expressed an interest in participating.

The coordinator and facilitator met regularly during the first semester of the project. These meetings turned out to be very fruitful in terms of project design and scholarly inquiry. During these meetings, two main course enhancements were identified. The first activity was to develop Web "Case Pages" for use in the course. A case page will be a multimedia Web page that describes a case that exemplifies a course concept or presents an opportunity to apply a course concept. For example, a case page could describe the concept "learned helplessness" by describing relevant research, showing a video clip of a student explaining why she cannot perform a task, links to other information sources and reflection questions. Case pages will be used to set the stage for class and bulletin board discussions. They may also be used in a distance-learning version of the course.

The second activity focused on scaffolded discussions. Advanced discussion board "modules" will be developed and then utilized throughout the course. These modules will utilize the most current ideas in the areas of computer supported collaborative learning (Koschmann, 1996) and knowledge building (Scardamalia & Bereiter, 1991). The approach used to facilitate the scaffolded discussions will be determined through a literature review of the above areas. It is expected that the review will produce several alternatives programs and/or approaches to the facilitation of these discussions. To make plausible the use of the case pages and scaffolded discussions, the project facilitator will work with the participants to move their courses online with WebCT.

Once the main activities were identified, we then delineated the expectations of each of the participants:

Coordinator

-Supervision of Case Page development
-Discussion board questions (scaffolds)

-Sharing with course instructors
-Participate in orientation meetings
-Meet w/ facilitator every two weeks

Facilitator

-Work with case page development
-Research scaffolding software (e.g., Knowledge Forum)
-Work with course instructors
-Coordinate participant meetings
-Meet w/ coordinator every two weeks.

Course Instructors

-Participate in two orientation meetings (prior to implementation)
-Participate in three meetings (two during implementation and one end-of-semester)
-Use WebCT
-Integrate Case pages and scaffolding tools into their courses

Needs related to the project were then discussed. It was clear that a Web development person was necessary to develop web case-pages, provide assistance with capturing the multimedia materials necessary for the cases and developing a home page for the course that could be used by all the sections of the course. Other needs included materials such as software (e.g., scaffolding program such as Knowledge Forum and video editing software) and hardware (e.g., video capture equipment). These needs and a small stipend for each of the participants would be funded by the Preparing Tomorrow's Teachers for Technology grant program.

Research Potential

A key component requirement of this project is that the activities meet several needs and not be limited to the need to model effective uses of technology. The instructors involved should also have the opportunity to use the project as a way to address some scholarly questions. By using electronic tools such as Listservs and WebCT, data collection becomes much easier than traditional methods. When the participants learned about some of these tools, they immediately envisioned several scenarios that were ripe for investigation.

As a result of the team discussions, several research projects were discussed. The first project will report on the efforts of the faculty to renovate the courses through the use of technology. This project will utilize a listserv as a forum for discussion of the group activities, trials and successes. Several different levels of expertise are represented in the group of instructors and it will be interesting to follow the discussion between them as the course proceeds. Another project will compare the perceptions of students in sections before and after the course improvement. One of the problems with a large introductory course such as this is that students fail to see connections between the course content and their goals and experiences. Our hope is that the use of technology will help make some of these connections by fostering greater communication with their peers.

In addition, to research projects that will review the cornerstone project, several other studies will be conducted the deal more directly with the interests and expertise of the participants. The coordinator for the Educational Psychology course is interested in argumentative reasoning and will investigate several research questions while observing the course discourse in the online bulletin board. How these discussions are facilitated is an area that is in dire need of investigation. Other members of the group are interested in various learner characteristics that they have studied in more traditional forums. For example, one member is interested in the relationship between epistemological beliefs and achievement. How these beliefs impact students participation in the online discourse is another area the will be further investigated as a result of this project. Investigating so many questions in one semester would be extremely difficult if it weren't for

the collaboration that has occurred and will continue to occur during the implementation of these course enhancements.

Discussion

While the activities related to the project have only just begun, it is clear that the approach has the potential to have a lasting impact for virtually all of the preservice teachers in our program. It has also resulted in some powerful collaboration between different departments in the college both in terms of pedagogical and research issues. Insuring the next generation of teachers can use technology in an effective way will require a systemic and multifaceted reform of our teacher preparation programs. The cornerstone course can play a key role in that reform.

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Technology In The College Classroom - Preparing Teachers To Use Technology

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Abstract: The panel presentation herein shares strategies and outcomes of the implementation of the SOWEGA PT3 (Preparing Tomorrow's Teacher to use Technology) Project at Albany State University (ASU). The strategies are: (1) Infusing technology into core courses that will serve as models for future teacher, (2) providing technology training to faculty in collaboration with the Education Technology Training Center to strengthen technology competence system-wide; (3) encouraging the development of technology intense course materials, (4) awarding mini-grants to faculty members who will promote the interests of the SOWEGA PT3 project; (5) targeting pre-service teacher for Intensive Technology (InTech) training, and (6) collaborating with area schools to encourage student teachers utilizing technology at schools where they are doing student teaching. The PT3 project has fostered multi-disciplinary activities that promote active use of technology.

Introduction

The SOWEGA Project is the Preparing Teacher To Use Technology (PT3) – funded initiative on the campus of Albany State University, a 100-year-old historically black university in southwest Georgia with a College of Education that graduates over 140 teachers each year. To prepare graduating teachers proficient in using technology in the classroom, the SOWEGA Project proposed a multi-disciplinary effort across the Colleges of Education and Arts and Sciences that would engage college faculty to model technology-rich teaching. Using this approach, a mini-grant process enabled faculty to address changes through revising syllabi, taking training courses in technology applications, working with technology-trained K-12 faculty and student teachers.

The panel presentation intends to share outcomes of the first 18 months of this effort, using evaluation outcomes and faculty participant interaction to enrich the panel. College faculty in mathematics, in the natural sciences, in English and modern languages, in social science and education courses revised their teaching strategies. In the course of designing new syllabi, faculty all engaged in a training process designed for Georgia teachers, called InTech. This intensive 7-day process uses skill application from Microsoft Office, coupled with other software and Internet skills to guides participants through a process that results in four new one-hour lesson plan designs. The InTech model is being adopted in other states for its excellence and relevance to INTASC standards for technology in the classroom.

Student teachers are also engaged in going through the InTech process, which has recently become a requirement for re-certification in Georgia. A culminating activity held at the ending of year one was the "Summer Seminar", a day filled with presentations shared by SOWEGA Project mini grantees, student teachers and K-12 teachers who completed the year of learning to enrich teaching through applications of technology. Some outcomes of the first year include: revisions of critical core courses, including Trigonometry or Pre-Cal, a process that engaged all mathematics faculty who periodically teach the course. One immediate outcome has been that 90% of the mathematics faculty have been trained in InTech, exceeding the proposal objective expectations; the faculty in English and Modern Languages also experienced a high rate of participation in the InTech training; in Teacher Education three faculty revised the Foundations of Education course and other faculty revised a reading course to produce student-produced multimedia books. In physical science, one of the core lab sciences taken by teacher education and all other majors, faculty used java programming to design a web-based simulation of basic principles of physics; and in history, faculty revised syllabi to enrich core courses using Internet resources. It is sharing of the cross-disciplinary efforts demonstrated in the SOWEGA Project, resulting in new technology skills for college faculty and for teacher education students that will be the focus of the panel presentation.

The first presenter of the six panelists, Betty Hatch will introduce the vision and planning of the project. Then Gerald Burgess will present the important role of InTech in PT3 project. Next Samuel Masih will provide insights on faculty development and implementation of a technology-intense Pre-calculus course. Our third presenter Rosemarie Mundy-Sheppard will share the excitement of infusing technology in English and social science courses. Next K.C. Chan will showcase the infusion of Java simulation technology for natural sciences and web database for the e-commerce. And finally Rani George will present a summary of the progress of the SOWEGA project using the results and findings of both the internal and external evaluations.

Panelist 2: Gerald W. Burgess, New Roles in Teacher Education: Creating Technology Connected Lessons

The media's attention on our nation's dependence on computer technology has no greater evidence than the impact of Y2K. Website addresses have become part of the language where the phrase "dot com" permeates our speech and is seen on billboard advertising. As future teachers move through our schools of education, technology is being taught as both an educational delivery method and instructional communication tool (Imel, 1999). Quality teaching in the 21st century will require teachers to be knowledgeable about a technology influenced student body and how to create learning environments, which integrate technology in the support and delivery of instruction. Teachers in the new millennium should view technology as a cognitive tool that has the potential of encouraging inquiry-based learning and reinforcing instructional concepts. Planning technology connected lessons will require teachers to think more creatively about how students learn and plan lesson which respond to the vast variety of learning needs. The positive effects of technology far outweigh their disadvantages when applied correctly. The greatest effect is that of contextualized learner-centered activities with the emphasis placed on student learning not teacher teaching. This multimedia paper will discuss technology connected lesson plans, their impact on teaching, student motivation and instructional delivery. The authors will outline strategies for developing technology connected lessons and discuss a model used by the Georgia Framework for Integrating Technology in the classroom.

Colleges of Education, especially those in teacher education, are entering a new era if they are not already in it. It is the era of the Technology Connected Lesson. The new technologies of the late-1990s, television broadcasting, satellite transmission, Microcomputers, the Internet, and the World Wide Web (WWW) are shaping the way we deliver information in the classroom. Its not so much that lesson planning is different today than 20 years ago, but planning a technology connected lesson today has more to do with the way we think about technology, use it, and focus student's attention on it. Technology is a tool. It's not the process, it's not skill development, it's a tool to research, communicate,

and to publish. The problem is that we continue to think about lesson planning the way we did 20 years ago in terms of delivery of information rather than student involvement with the information and knowledge we expect them to gain. This paper will explore some of the issues surrounding developing Technology Connected Lesson Plans and their impact on teaching, classroom, student motivation and instructional delivery. The authors will strategies for developing lesson plans and discuss a model used by the Georgia Framework for Integrating Technology into the classroom.

InTech Program Description:

InTech is an intensively structured, 50-hour, Georgia Department of Education Professional Development Program. It provides many examples of effective technology-based strategies that support and enhance curriculum and can serve as a catalyst for fundamental change in the overall teaching and learning processes. One of the strengths of the program is peer-instructor modeling of technology-connected lessons. Developing skills in the following five critical areas characterize this integrated training approach: (1) Use of Modem Technologies, (2) Curriculum Integration, (3) Designs for Learning (4) Enhanced Pedagogy and (5) Classroom Management. Participating teachers learn basic technology skills while focusing on project-based activities that use Georgia's Quality Core Curriculum.

Initial training includes five-days and two follow-up days. DOE and DOE Regional ETTC's coordinate the on-going training of trainers and the publishing of technology-connected lesson plans. Support for this training will make extensive use of the Georgia distance education networks, Peachnet, PeachStar and GSAMS.

Program Criteria:

School Principals will agree to:

- Select a team of five teachers from selected critical content areas and grade levels, media or technology specialists and/or administrators. The team will agree to the requirements for participants listed below.
- Plan for seven release days from classroom duties for each team member.
- Plan to provide a multimedia workstation and software for each participating teacher.
- Attend an information session prior to the first training day.
- Attend a minimum of 10 hours of InTech training.
- Attend two one-half day workshops: #5775 Understanding the Classroom Module and #5800 Evaluating Teachers in a Technology Connected Classroom.

InTech Participants will agree to:

- Attend seven eight-hour training sessions (8am-4pm).
- Critically examine their own instructional practices to determine how technology can play a role in enhancing the teaching and learning process.
- Implement four technology-connected lesson plans and complete all InTech assignments (journal reflections, professional readings, email responses, etc.).
- Develop a group project that displays teacher-created materials and student-created projects developed during InTech. The project may be a tri-board, portfolio, electronic portfolio, etc.

Creating Technology Connected Lessons require a change of perspective, a process, standards, and the teacher. The place to start is with the curriculum – your expertise. Technology-connected activities should be based on ideas and concepts that you are teaching, with the activities being of critical importance to what students need to learn. As plans are developed, technology is used as the tool or the vehicle for acquisition, organization, evaluation and application of knowledge. Teachers in the new millennium should view technology as a cognitive tool that has the potential of encouraging inquiry-based learning and reinforcing instructional concepts. Planning technology-connected lessons will require teachers to think more creatively about how students learn and plan lesson, which respond to the vast variety of learning needs. The positive effects of technology far outweigh their disadvantages when applied correctly.

Panelist 3. Samuel Masih (Mathematics and Computer Science), Pre-Calculus Instruction Incorporating Technological Tools

The purpose of this activity is to provide a model of teaching and learning using the technology. In order to implement this objective, the PT3 provides mini-grants for mathematics faculty to acquire any technological tools and necessary release time as needed to revise their syllabi and to develop technologically rich lessons for presentation and delivery of course content. The intent of the mini-grants was not to teach the students technology know-how, but to construct an effective model of applying the technology in their teaching. This project incorporates technology in the pre-calculus course, which is required of all mathematics and science pre-service teachers and is taught by arts and science faculty. Since there are several sections of pre-calculus course, it became evident that in order to truly implement this objective all sections of pre-calculus would have to participate in this venture. For this reason there are five faculty in the Department of Mathematics and Computer Science that are Co-PI's in this mini-grant. The strategy for incorporating technology in the pre-calculus course was to develop a common syllabus for the course that addresses the use of technology. Fortunately, the Department of Mathematics and Computer Science at Albany State University already had many of the needed technology components that could be used to accomplish the objectives in the mini-grant. The course was redesigned to incorporate several major technological tools in the delivery of the course content. These were as follows.

1. Interactive Pre-calculus Software (IPS)
2. Maple V mathematics software
3. Access to the Internet
4. Technology Training Center (INTECH)
5. Microsoft Office Tools such as Power Point
6. Graphing calculators such as TI-83

All faculty in the mini-grant took INTECH training in the summer. Each faculty developed some technology rich lectures that could be shared by other faculty. A web-based tutorial system was developed for the course that provides common syllabi, study guides, homework assignments and help on the homework assignment (http://www.asuemath.asurams.edu/precal). From this page a student could branch out to

specific assignments given by individual faculty. Access to the page is authenticated to keep track of the use of the web-based activities in a database. The database keeps records of student activities and provides feedbacks to individual faculty about their student activities for the purpose of evaluation. This page also provided means of collecting data on the web about students in the pre-calculus course.

Another important component in the course is the use of the existing Interactive Pre-calculus Software (IPS)(http://newton.asurams.edu/~smasih/precal). This software provides interactive multimedia instruction in the precalculus. The software is installed in the computer laboratories and is made available to students and faculty. It is used by the faculty for providing interactive simulations in the classroom as a part of their lecture and to subsidize instruction. The software is useful in stimulating discussion in the classroom. Students who are not doing well in the class are required to go to the laboratory and use the software to remedy their weaknesses. The computer laboratory also provides access to Maple V software. Maple V is a powerful software tool for doing mathematics and a great tool for simulations and graphing in the classroom. General workshops are conducted outside the classroom for the use of IPS and Maple V. Students are required to attend the workshops. As an incentive, the students earn 10% of their grade through doing activities using technology.

Several pre-service teachers are hired as student assistants by the mini-grant faculty. The faculty act as mentors to these students and use them in creating technology rich lessons and web –based material for their classes. These students are required to take INTECH training. An in-service teacher in the school system is associated with the mini-grant. The pre-service interns visit this teacher's classroom and provide help in the incorporation of technology rich lessons.

Outcomes. The following table shows the impact on arts and science faculty and pre-service teacher. A survey instrument is used to determine the number of pre-service teachers in the pre-calculus courses. A survey instrument is used to determine the number of pre-service teachers in the pre-calculus courses. An evaluation survey is conducted to see the impact of the use of technology. The following table provides a rough data concerning technologies used in instruction.

Percentage of potential Education majors in pre-calculus courses in the Fall 2000	29
On a scale from 0 to 5 the result of the Technology Survey is as follows	
1. The use of Interactive Precalculus Software in the class in teaching	4
2. The use of Interactive Precalculus Software installed in the computer laboratories	3
3. Web-based exercises and home work assignments	3
4. Help provided for the Web-based exercises and homework assignments.	4
5. Workshop in the use of Maple V software teaching	3
6. Using graphing calculator	4
7. Over all technology use in the class room	4

Table. 1 Percentage of potential education majors in pre-calculus courses in the Fall 2000

Some of this data is incomplete at the time of the writing of this paper. At the end of the Fall Semester 2000, all the data will be looked at for seeing the impact of all the technology components incorporated in the mini-grant.

Panelist 4: Technology Infusion in English Classroom, Rosemarie Mundy-Shephard (English)

The implementation of Technology Infusion in the English Classroom carries the following components: selection of the English Composition II--1102 course for technology infusion, in- depth training for pre-service (student) teachers, forming partnerships with service elementary and middle school teachers in prompting the use of technology, and, most importantly, establishing a technology team in the English Department at Albany State University. English Composition II was targeted for the implementation of technology. The students were first given a pre-course survey to gauge their technology backgrounds and attitudes. To demonstrate the use of the technology in teaching English, wireless laptops were used in the classroom by students to perform literature searches via the Internet, some learning games were designed (such as Dante's Inferno Game) to arouse students' interests, and the digital camera was used to illustrate the power of imagery in conjunction with literature. Parts of these activities supported the technology-enriched assignments for the students. For instance, to prepare for the full participation of the game, students completed a rigorous review of their work. Also, students tested their literal learning and review online as they competed and answered trivia questions on the assigned readings. Overall, students in the English Composition 1102 class completed a basic search for research materials, learned about useful composition websites and sent email communications to the instructor and at least one other student in the class. Moreover, instruction was enhanced because students enjoy using computers for research. All the work described required intensive preparatory effort. Pre-service students were recruited to participate in the implementation of the above strategy. The pre-service students attended an intensive In-Tech training class, where they learned how to use hardware (digital cameras, scanners, printers, laptop computers, and zip drives) and software (such as Microsoft Office Excel, Database, and Inspiration). These pre-service teachers also prepared Newsletters and created a Totem and templates for assignments, involving every aspect of preparing technology for teaching. To further prepare the student teachers for technology, we have established partnerships with in-service teachers in the local schools. In the process, these teachers were In-Tech trained as well. Because of the pilot project, we have generated enough interest in the department to assemble a team of teachers interested in adopting the technology and continuing the expansion of infusion of technology into the classroom; four of the faculty members on the team were In-Tech trained because of the process. In conclusion, PT3 has made a significant impact on the Department of English to incorporate the use of technology for core-level English instruction.

Panelist 5: K. C. Chan, Infusion of Java Interactive Technology into the Physical Sciences (Natural Sciences) and Infusion of the Web Technology Into Fundamental Computer Applications (Bus. Admin., Chiou-Pirng Wang)

A. Infusion of Java Interactive Technology into the Physical Sciences

Science is a difficult subject to learn because it involves concepts based on dynamic events and spatial entities that are awkward to be presented on 2 dimensional media such as textbooks and blackboard. Computer technology has broken this barrier and the Web has rendered

computer simulation and visualization tools widely available. Thanks to Java technology, Web browsers today are capable of performing highly interactive computer simulation for all kind of science disciplines. Many high quality interactive Java applets for sciences are available on the Internet. The Interactive Java Project supported by the SOWEGA PT3 has decisively helped introducing Interactive Java into physical science course PHYS 1001K offered at Albany State University, a core course require by non-majors and education students. The intention of the project is to provide a learning and teaching model for student teachers who take this course.

The implementation of infusion of interactive Java includes the following stages:

1. Develop and compile existing java applets that are suitable for physical science curriculum.
2. Train the student to write his or her own web pages and use intranet for files access.
3. Train students to use the applets selected for the class project.
4. Ask students, as a class project, to develop an instructional web page based on their understanding of the applets and integrate it with the applet to develop a lesson page—not a lesson plan—to teach their fellow students the content conveyed by the applet.

This project is technologically intensive for the students in the course. First the student spent 10 hours learning how to create web pages via the InTech program. Then each student had to select an applet related the course content or be assigned one in random. The student must then master the content knowledge of the applet and the idiosyncrasy of operating the applet before creating an effective lesson. Then the student would present the result before the class. Students who had successfully finished the project would have a good grasp in how to apply interactive technology in teaching science and how to tap into vast Java resources available on the Web. Consequently, the project has developed three interactive java applets in house plus more still in development. Table below list eight such applets representing phenomena that are easy to understand when simulated but hard to understand when present in static media.

Applet Title	Contents
1. Transverse Wave	Wave and wave propagation concepts
2. Longitudinal Waves	Wave and wave propagation concepts
3. Interference	Interference property of wave
4. Pendulum	Parameters that controls pendulum motion
5. Light Rays	Light ray travels in straight line
6. Colors	Mixing of primary colors
7. Fluids (In house)	Fluid flow—conservation of mass
8. Frequency (In house)	The different between frequency and speed

Table 2. Selected applets

Evaluation. Student performance was evaluated not by objective testing. Instead students were graded according the following rubrics:

1. Do students understand the concepts well? (Based on student presentation and from the contents of their web pages)
2. Could a third person follow the instructional steps constructed by student author to use the applet effectively and correctly? (i.e. is the instruction clear and easily to follow?)
3. Are the steps or construction of the lesson clearly leading to learning objectives conveyed by the Java applet?
4. Are the concepts and instruction steps coherently represented?
5. Are student technology competent?
   - Can the student create the web page and upload it to the server location successfully
   - Can the student transfer file via the Intranet?
   - Can the student manipulate the Applet?
   - Can the student use the multimedia equipment to present the result properly?

Outcomes. Basically we have accomplished the mission of infusing technology into the classroom in a way that students can apply their new skills in how to use the technology for learning and teaching. The outcomes of the project could be viewed in two aspects: the technology know-how and the content knowledge. Since our emphasis is on content knowledge based on the foundation of technology, the outcomes of the project could be tabulated as shown in Table 2. In the end, eight web lessons were created.

Table 3. Evaluation of PHYS 1111K student performance

	Pre-project Experience/Knowledge	Post -project Experience/Knowledge
Technology Operation Skills 100% = tasks accomplished 0 % = No prior experience	Web page development 0% Network File Transfer 0% Java 0% Computer Projector Presentation 0%	Web page development 100 % Network File Transfer 100% Java 100% Computer Projector Presentation 100%
Content Knowledge	0 – very limited knowledge	Grades: 25.0 % **A** 25.0 % **B** 37.5 % **C** 12.5% **D** Based on understanding reflected by the student's web lesson.
Web Authoring	none	Author a Web lesson

B. Infusion of the Web technology into Fundamental Computer Applications, Chiou-Pirng Wang P. (Department of Business Administration and Education)

Microsoft InterDev 6.0, HyperCam, and Access Database were added to the traditional Fundamental Computer Applications for Business BISE2010 that teaches only word processing, spreadsheet, and PowerPoint presentation and database. The modified course demands students to

create a database driven Web Pages using the InterDev. To get students up-to-date to the e-commerce technology, they must master the Web pages creation, Web forms and database concepts, connection of database to the server from the client, retrieval and update of database records. All these, even with the help of InterDev is procedurally too complex for students to learn in a short period of time, so HyperCam is used to prerecord some intricate procedures for playback by students later, just in time of need. Also, simple built-in Java and Visual Basic scripts were the first time introduced into this popular course. The class devotes 1/5 class time to the Web-based database. A post and pre-survey given to gauge the level of student understanding on the web-based database after a summer session is given below. It demonstrates the approach is working well.

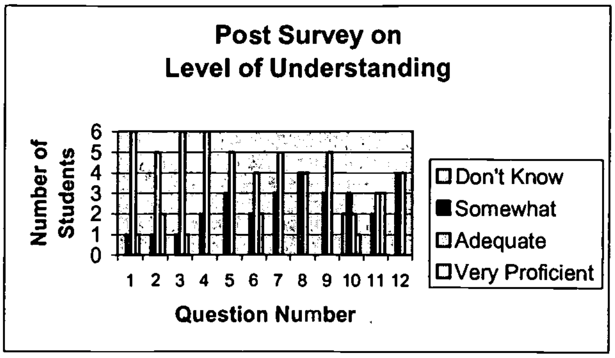

Fig. 1 Post course survey results.

Panelist 6: Results of the Evaluation, Rani George (Education) and Technology and Student Constructed

A. Results of the Evaluation

The major aim of any evaluation is to collect, analyze, and interpret information on the need for, implementation of, and efficiency of programs and intervention efforts. The evaluation helps answer the following fundamental questions: (1) Has the PT3 project achieved its goals? (2) How does technology impact learning? (3)How can we prepare tomorrow's teachers to use technology in their classrooms? (4) What changes are required in the curriculum for teacher preparation programs?

To answer these questions the project performs bipolar measurements, one set from the student and the other from the instructor. On the student side, the measures are student testing, projects, essays, extended performances, portfolios, student attitudes, morale, and satisfaction. On the teacher side, we evaluate Teacher's use of technology in the classroom, attitudes, satisfaction, competence, and curriculum changes.

I. Baseline studies

Subjects for baseline evaluation consists of 493 students, 18 ASU faculty, 7 mini-grant recipients, and 22 Summer Seminar Participants. Students answered a 37-item computer attitude survey. More than 85% reported positive attitudes toward the use of computers and a high degree of comfort in using the computer. Faculty responded to a survey, which measures faculty use of basic technology in their teaching and regular daily activities. Based on the results it can be stated that competency with basic computer operations ranges from beginning to more advanced. A system wide survey is underway to get a better understanding of faculty's level of technology competence. Of the 22 participants who attended the summer seminar 95% rated the seminar as an "outstanding activity" and stated that they received "ample information." Further evidence of technology comes from data that show that 32% of the faculty in the Colleges of Education and Arts and Sciences and 5% of Education majors have had InTech training. All the students enrolled in Prep for Teaching are currently undergoing InTech training.

II. Evaluation of the syllabi redesigned for technology infusion.

Six of the seven original syllabi had little or no technology components. The seventh added more advanced features to the technology already in use. Another set of 8 faculty members (2 English + 5 Math + 1 Business) have signed up to add technology components to their teaching. The findings related to the revised syllabi are complex. Two questions stood out in the evaluation of a syllabus (1) How often does the revised syllabus include technology? (2) What evidence is in this syllabus to indicate that, as a result of this course, students will know and/or be able to do the competences indicated in the standards? When judged against the National Education Technology Standards, the syllabi were found to echo strongly with the standard Technology Operations and Concepts but weak in Social, Ethical, Legal, and Human Issues. The table below shows two of the standards and the extent to which the seven course syllabi echo the standards.

Standard I. Technology Operations and Concepts
Standard II. Social, Ethical, Legal, and Human Issues

Syllabi	A	B	C	D	E	F	G	Examples of Evidence
Frequency of the syllabus satisfying standard I.	6	17	5	6	8	9	6	.Establish and use email account; join listserv .Use interactive software simulation .Use Internet for resources and research .Use computers, calculators, and other technology in completing assignment .Create Web Pages with data source link and site diagram .Demonstrate proficiency in computer-based search technology
Frequency of evidence that the syllabus satisfying the standard II	0	0	3	0	0	0	0	. Identify and describe teachers' responsibilities related to computer ethics. . Design student-learning activities that foster equitable, ethical, and legal use of technology by students.

Table 4. Evaluation of the syllabi redesigned against NETS standard

B. Technology and Student Constructed Books--Telling Stories of the Past-- a Bibliotheraphy,
Onetta Williams

The PT3 project has enable the introduction of technology to an Early Childhood Developmental Reading Course -- ECEC 3355. In the course, students learn to *follow directions explicitly*. Typically a child will secure a piece of wallpaper that measured 10 ½" X 14 ½", two pieces of mat board measuring 5 ¼" X 8 ½", a bottle of rubber cement, fold in half 5 sheets of copy paper, andtaple the sheets down the folded side to make a blank book. Then, the student starts to write the story. The student is required to recall an experience that occurred during their childhood when they were in the early years of school. The student will write the story, based on this remembrance, distributing it throughout the book on the front and back pages of the each page until the end of the story is reached. This hands-on textual learning is an important part of learning in early childhood and should also be done as an enhancement to the technology component of the project. However, to render the storybook attractive and impressive, students are encouraged to add the graphics and use the scanner and computer graphics programs tot support the content of the story. The student is encouraged to use old childhood photos and scan them into computer for software rendering and/or filtering them for inclusion into the book. After finalizing the written part of the story, the student will bind the book using a techniques modeled by the teacher. Finally, students will present the finished books enhanced by technology in a Book Showing where the entire class, families, and other faculty members are present. Refreshment are served and classical music is played softly to set the mood for the books to be read..

Bibliotheraphy is a technique used in book writing to help the student "get the story told". Often a young child experiences an event that leaves a lasting impression and the feelings from that event is never voiced, but remembered. In Developmental Reading, when students are required to reflect on an experience that took place when they were young, they often recall these previously mentioned events. The student chooses to write about this event and takes great care to use the "perfect" computer graphics and make use of the scanner to include photos of family members and the student himself. Often, the entire family gets involved with the writing of the project to ensure the authenticity of the book. When the story is read at the Book Showing, it often evokes tears and happiness within the student at the same time because the "story is finally told". Technology has added a happy dimension to the equation.

Conclusion.

In conclusion, we have presented here our overall strategies on implementing a system wide approach to prepare tomorrow's teachers to use the technology. Our framework is based on faculty peers training and InTech training, technology based model classes, intensive technology training for pre-service teachers, and collaboration with in-service teachers from local schools which desire to implement technology in the classroom. InTech plays a crucial role in training faculty and pre-service teachers and students alike who lack the fundamental technological skills. Based on the InTech foundation, we then build technology-based core courses and use them as models to showcase them to pre-service teachers as well as to faculty. It is important to notice that, as demonstrated by the presentation of the panelists mentioned above, the level of technology sophistication could vary significantly from discipline to discipline. Instead of standardizing education technology across the board, peers in each discipline, such the mathematics and English departments mentioned earlier, should be given an opportunity to decide on their own comfort level of technology needs. An appropriate technology, which matches the need of the discipline and its courses, is more important than the sophisticated and state-of-the-arts technology skills ever invented. For instance, the use of a scanner and computer to help capture images for the construction of a manual storybook by a child is highly effective for promoting early childhood reading; yet too much technology may damper the effectiveness of the hands-on approach. Based on this philosophy, the SOWEGA PT3 project is going to continue its effort to create more model courses that encompasses all kind of technological usages so that, in the end, no mater which core course an education student and hence the future teacher may take, he or she will be exposed to an usage of the technology.

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Use of Development Teams in Problem Finding

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Abstract:
Educators emphasize unit construction as an important part of teacher preparation. Technology-enhanced problem-based learning units are particularly exciting because they have the potential to involve students in complex, realistic problems that are both engaging and cognitively challenging. These units are difficult to develop, however, particularly for elementary education teacher candidates who often have limited content knowledge. The authors have enlisted arts and science faculty experts to participate as members of "development teams" to assist in the design of problem-based units in science and social studies. This collaboration produced units in which content is richer, problems are more complex, and resources are more substantive.

In teacher education, science and social studies methods courses typically include unit development as an essential skill for teacher candidates. Units of study provide an important vehicle for presenting content in a cohesive way, for integrating information from different disciplines, for putting content into a relevant, meaningful context, and for blending skills with content. Noted educators and educational researchers have long emphasized the value of curriculum integration (Whitehead 1929) and cautioned against the teaching of skills in isolation (Perkins 1986), so unit construction is an important competency for teachers.

Technology-Enhanced Project-Based Learning

Units come in many formats, each with its own strengths and underlying principles. In our methods courses at Elon College, we recently adopted technology-enhanced project-based learning as the unit model to use with our teacher candidates. In a project-based unit, students are presented with a situation or scenario that calls on them to accomplish a task or develop a product. They may be placed in roles that demand the adoption of a particular approach or the use of a particular set of skills. For example, one team of our teacher candidates developed a project-based unit that placed their fourth grade students in the role of journalists covering flood relief efforts in eastern North Carolina after a series of devastating hurricanes hit the coastal region of the state. The fourth graders were asked to investigate the storms, the resulting damage and subsequent relief efforts, then to write articles for "*North Carolina Today*," a magazine they fashioned after prototypical news magazines.

We selected the project-based learning unit model for several reasons. First, a project-based learning unit provides an authentic learning environment. Activity theory suggests that we learn by doing (Jonassen & Rohrer-Murphy 1999). Vygotsky, Leont'ev and other Russian psychologists (Wertsch 1981) have brought this idea to the educational forefront and given it theoretical validation, but it has immediate

face validity as well. We learn when we want to learn, when we need to learn, and when we are interested. Learning happens almost without our being aware of it when we are deeply engaged in a project that is meaningful to us. Too often "school learning" is neither engaging nor meaningful. Skills are learned, but never applied in real-life situations; facts are learned, but never associated with important principles; concepts are memorized, but without being understood. Research confirms that transfer to out-of-school situations is unlikely when learning is so contexualized, so embedded in the classroom environment (Lave 1988; Perkins & Saloman 1988).

Second, project-based learning allows us to explore a content area in depth. With the amount of information in mandated curricula today, coverage is a major issue with teachers. The result is sometimes referred to as the "iceberg" approach to teaching, where only the tips of many knowledge areas are touched upon, none in depth. Project-based units provide opportunities to delve into subjects and emerge with deep understandings. For example, students in fourth grade might be expected to define a hurricane and to distinguish it from a tornado, and/or they might be expected to identify relief agencies and to list their functions. Approached this way, the topic of storms can easily be covered in a day or two, but activities such as these do not encourage the in-depth learning that is demanded by the project scenario developed by our teacher candidates

Third, project-based learning encourages both content integration and skills infusion. Projects are by their very nature integrated. Science, social studies, language arts, and mathematics all figure into the flood relief scenario outlined above. In addition, the writing assignment is a natural one. Students learn how to write in a particular fashion, to a particular audience, because they are placed in a role where that is what they must do – it is their job. It gives a whole new meaning to the writing assignment and actually does not seem like an assignment at all.

Though we could enumerate other reasons, the last one we will mention here is that project-based units provide a natural way to integrate technology into the curriculum. It is crucial for teacher candidates to begin to integrate technology into their instruction so that when they enter the teaching profession they can teach necessary technology competencies to their students. Project-based learning provides a natural vehicle for technology use because it is so clearly enhanced by technology (Moursund 1999). There are opportunities to organize information using databases and spreadsheets, to study new concepts using computer models and simulations, to present ideas using multimedia, and to conduct research in an authentic, collaborative environment.

Problem-Based Learning as a Type of Project-Based Learning

Some projects involve solving a problem, and when this is the case, project-based learning becomes *problem*-based learning (PBL). Though the difference is not always clear, the two can be distinguished in the following way: With project-based learning the emphasis is on the *product*, with problem-based learning the emphasis is on the *process*. The project-based learning unit we outlined above had students concentrate on locating information and writing a news article. If students had been asked instead to devise a plan for minimizing flood damage following hurricanes in eastern North Carolina, then they would have had to engage in substantial higher level thinking. The concentration on the complex thinking required in the project, rather than on the final product, suggests a more problem-based approach.

Because critical thinking and problem solving are crucially important skills, we encourage teacher candidates to develop projects that center on problems. As Rutherford and Ahlgren (1990) point out when they report on Project 2061, it is important to have students interact with significant problems:

> Students should be given problems – at levels appropriate to their maturity – that require them to decide what evidence is relevant and to offer their own interpretations of what the evidence means. This puts a premium, just as science does, on careful observations and thoughtful analysis. Students need guidance, encouragement, and practice in collecting, sorting and analyzing evidence, and in building arguments based on it. However, if such activities are not to be destructively boring, they must lead to some intellectually satisfying payoff that students care about. (pp. 188-189)

However, we have found that problem-based learning units are considerably more difficult for our teacher candidates to develop than are project-based units. While candidates have little trouble identifying meaningful products, they have a great deal of trouble finding worthy problems. Before considering why this might be so, let's briefly address what makes a problem "worthy."

Stepien and Pyke (1997) stress the importance of PBL problems being "messy," or "ill structured." That is, the problems require more information than is initially available to solve them, and there is no single "right" answer (Barrows 1985). These qualities encourage students to think creatively, form hypotheses, identify issues and questions, search for relevant information, and think critically about the data they collect. Gallagher (1997) points out, however, that being ill-structured is not enough. PBL problems should be constructed around learning goals and should have a conceptual focus and disciplinary relevance. Content is not incidental, but central to this form of problem solving. Because PBL is premised on the assumption that problems will motivate students to explore curriculum topics in greater depth, the problems themselves must be carefully designed to lead students into that curriculum.

Boyce, VanTassel-Baska, Burruss, Sher, & Johnson (1997) point out the importance of problems being realistic. They have found their science curriculum units are more powerful when the problem is tailored to create a localized ill-structured problem, rather than an entirely fictitious one. This encourages students to use a rich variety of local resources to address the problem. Indeed, the location and use of appropriate resources is another important aspect of PBL. Boyce et al. note, "Students need to do more than check the encyclopedia. Science books and databases, local resources and experts, journals, and Internet consultations with people across the country enrich the creation of students' solutions for the problem" (p. 375).

In summary, worthy PBL problems are open-ended, complex, realistic, and steeped in significant content. Now we must ask what it takes to find such problems. At the very least, it takes a sound foundation in the content area. In order to identify worthy problems that are realistic *and* that implicate core disciplinary content, one needs a deep understanding of the subject matter and its current status. This may explain the difficulty our elementary education majors have with problem-based learning.

Content Knowledge and Elementary Education Majors

The lack of adequate content knowledge among elementary education teacher candidates has been studied and well documented. In *The Rise and Stall of Teacher Education Reform*, Fullan, Galluzo, Morris, and Watson (1998) identified the need for a stronger knowledge base for teacher candidates. Stoddart, Connell, Stofflett, and Peck (1993) investigated the mathematics and science content knowledge of elementary teacher candidates and reported, "many teacher candidates enter elementary teacher education seriously deficient in understanding the mathematical and scientific content they will be expected to teach" (p. 238). This was the case even though these teacher candidates entered the teacher education program after successfully completing college math and science requirements. The majority had grade point averages in the upper quartile of their college class. In a similar finding, Schifter (1993) suggested, "a major obstacle in the transformation of the mathematics classroom into an environment that produces mathematical understanding is that most teachers have not learned to think mathematically" (p. 271).

Our own observations of teacher candidates reflect these concerns. We find that teacher candidates are not only lacking in content knowledge, but they do not always recognize the *need* for a thorough knowledge of the content. They incorrectly believe that as long as they know more than the students, they are adequately prepared. An equally troubling concern is that even when teacher candidates recognize their lack of content knowledge and want to rectify it, they do not always know how to access the information they need. Combine these deficiencies with the recognition that teacher education faculty are not content area experts either and we have the scope of the problem. It is clear that, as Quinn (1997) says, "changes should be made in (teacher candidate) content courses, their methods courses, or both" (p. 112).

Development Teams

In order to effect such a change, we heeded the words of Jerome Bruner (1977), "The experience of the past several years has taught at least one important lesson about the design of a curriculum that is true to the underlying structure of its subject matter. It is that the best minds in any particular discipline must be put to work on the task" (p. 19). For us, getting "the best minds to work on the task" meant involving arts and sciences (A&S) faculty in assisting us to develop problem-based learning units of study. In fall 2000 we began a project (supported by a Preparing Tomorrow's Teachers to Use Technology grant)

that provided for the formation of collaborative Development Teams. In doing so, we were not only heeding the words of Bruner but also the admonition of the American Council on Education (1999) to coordinate the education faculty and the arts and sciences faculty in teacher education:

> A common problem in colleges and universities is that faculties and programs become isolated behind departmental lines. The responsibility for preparing prospective teachers in the subject areas they will teach rests not only with school of education faculty but also with faculty of the institutions as a whole – especially the arts and sciences faculty. (p. 21)

Recruitment and Collaboration

At the beginning of the project, we sent out a general meeting notice to A&S faculty who were recommended by teacher candidates or who previously had expressed an interest in working with future teachers. Encouraged both by the number of A&S faculty who responded to our call and by their level of enthusiasm, we met to explain the project. Afterward, we selected five faculty members with areas of expertise most closely aligned with the topics teacher candidates had been asked to address by their K-5 cooperating teachers, and Development Teams were formed. Each consisted of an A&S "mentor," four or more teacher candidates from the same grade level and/or with similar topics, their associated cooperating teachers, and a teacher education faculty member (one of the methods instructors). Content areas included geography, history, biology, and physics. Topics varied widely, ranging from "Matter" to "The First Thanksgiving."

Each of the five A&S faculty came to a methods class to listen to questions and to talk about their subject area. Teacher candidates were required to write a research paper on their selected topic and, in many cases, the A&S faculty reviewed the papers and provided helpful feedback. After that, it was the responsibility of teacher candidates to contact and communicate with their A&S faculty mentors. Not all Development Teams continued to meet, but at least four groups kept in close contact throughout unit development.

One of the most successful collaborations occurred in two teams of teacher candidates assigned to fifth grade social studies classes. Both teams were asked by their cooperating teachers to "teach about the western region of the U.S." They were asked to cover landforms, natural resources, major cities and landmarks, the economy, government, and people of the region. Knowing little about the western United States, the teacher candidates were at a loss about how to develop a problem-based unit on such a topic. Their A&S faculty mentor suggested that they address the topic through the problem of water shortage and water allocation, which would incorporate and focus much of the content they were asked to address. She worked with teacher candidates to help them develop this problem and locate pertinent print and Internet resources. At the end of the semester one of these students wrote, "Without Dr. G. I do not think that I would have been able to come up with a problem about the western United States. It definitely helped to get an expert perspective on things." Another wrote, "The water shortage issue was a good problem, a little hard to understand, but a good one because it tied geography into the issue. Before talking with her (Dr. G.) I was unaware that there was even this issue, so it is nice to have expert advice..." The water shortage problem and the issue of resource allocation provided an extremely rich problem situation for fifth graders to address.

Outcomes

We are encouraged by this initial attempt to establish and use Development Teams for problem finding, and we can report two positive outcomes at this point:

(1) Many A&S faculty are willing (even eager) to collaborate with teacher education faculty and teacher candidates on problem-based learning unit development, as this comment from an A&S faculty member indicates: "I think the interaction and discussion between faculty in the larger classroom was wonderful – a wonderful model of collegiality and of 'process' for the students. I thoroughly enjoyed interactions with students in the Development Team – this is where a lot of work and sharing and learning can be accomplished." We can also report that all five of the A&S faculty who served as Development Team members have stated their willingness to continue with the project.

(2) The quality of the problem-based learning units produced by Development Teams is discernibly higher. Unit evaluations indicate that in units developed in collaboration with A&S faculty:

- content is richer
- problems are more complex
- resources are more substantive

There are, however, some issues that need to be worked out. Only about 25% of teacher candidates developing PBL units worked in collaboration with their Development Teams beyond the initial meeting. One question, therefore, is how to get more active involvement between teacher candidates and A&S faculty on Development Teams.

Another issue is illustrated by a comment from one teacher candidate: "I did feel at times that Dr. G. got a little carried away about the topic, forgetting that we only had 10 days to teach the unit and that we were teaching fifth graders." This comment suggests that A&S faculty can overwhelm elementary education majors with the amount and the complexity of the information they give. So, another question is how to facilitate a meaningful dialog between the "experts" and the "novices" so that the information provided is ultimately useful.

A Technology-Enabled Knowledge-Building Community (Use of Knowledge Forum)

In recognition of the need to provide a platform for collaboration among Development Team members, we elected to use Knowledge Forum, a second generation CSILE (computer supported intentional learning environment) product. CSILE, an asynchronous discourse medium, was originally designed for information sharing and knowledge building among a group of learners. The conceptual bases of CSILE come from research on intentional learning and on the process aspects of expertise, and from analysis of how discourse in knowledge-building communities contrasts with that of the discourse found in typical classrooms (Scardamalia & Berieter 1994). This discourse also differs from current "ask the expert" arrangements that are being tried through e-mail. The CSILE-based approach more closely resembles "a community engaged in solving shared problems" (Scardamalia & Bereiter 1999), which provides an excellent fit for our project.

During this first semester we have not been able to do more than install Knowledge Forum and familiarize ourselves with its operation. Development Teams used email to communicate, and both teacher candidates and A&S faculty expressed the need for a better method of communication. Neither email nor the threaded discussion feature of our college courseware (CourseInfo) has proven satisfactory in providing a platform for the kind of dialog in which the Development Teams should ideally be engaged. Initial trials with Knowledge Forum look very promising in this regard.

Conclusion

The use of Development Teams in problem finding is an exciting component of our work with teacher candidates in the development of technology-assisted problem-based learning units. It clearly addresses the need for a strong knowledge base in the identification of worthy problems, but there are other benefits as well: A closer collaboration with the arts and sciences in teacher preparation, and the use of technology in a problem solving environment.

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Mentoring Collaboration to Integrate Technology into Science Curriculum: A PT3 Project

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Abstract: This paper describes an exemplary case in mentoring collaboration between the student teacher and cooperating teachers to integrate technology into the curriculum and discusses various activities that have occurred during the project. The educational technologist provided one-on-one and just-in-time coaching customized to needs in the context/placement classroom for a semester through the whole technology integration process. The project addresses three important problems/issues including: 1) collaboration between student teachers and cooperating teachers, 2) a model for integrating technology into the curriculum, and 3) communication among faculty in higher education, cooperating teachers, and student teachers.

Introduction

Every year hundreds of northeast Ohio K-12 teachers serve as cooperating teachers, opening their classrooms and providing guidance to pre-service teachers fulfilling their field experience requirements. We believe that the role of cooperating teachers is one of the critical factors to prepare pre-service teachers to model technology integration in their classrooms.

In the 1999-2000 MIMIC (Modeling Instruction with Modern Information and Communication Technologies) Project, a U.S. Department of Education grant program, K-12 cooperating teachers were recruited for mentoring from school districts that accept student observations, practicum students, and student teachers. Educational technology faculty from the participating institutions mentored small numbers of cooperating teachers to assist them in the development and implementation of technology in their teaching. Each team paired with an educational technologist and cooperating teachers implemented a context-based and content-specific approach for modeling the integration of technology for pre-service teachers.

This paper describes an exemplary case in mentoring collaboration between the student teacher and cooperating teachers to integrate technology into the curriculum and discusses various activities that have occurred during the project.

Background

Many researchers have reported that student teachers have few opportunities to apply what they have learned in the teacher preparation program. A study about effective supervision of student teaching points out that student teachers abandon what they have learned in teacher education courses in as little as two weeks rather than applying it into the placement classroom. In conventional student teaching, student teachers adapt and replicate the practices and attitudes of their cooperating teachers to facilitate the smooth function in the classroom (Richardson-Koehler, 1988). Rodriguez, Sjostrom and Alvarez (1998) report that nontraditional student teachers viewed and interacted with cooperating teachers as peers and friends, whereas traditional student teachers felt they could not overstep boundaries. The result of a survey on student teachers' success/failure in student teaching indicates that student teachers exhibited less confidence when using nontraditional approaches to teaching, particularly cooperative learning, individualized instruction, and integrated approaches (Gormley, et al., 1991).

Over the past decades, the administration in K-12 schools has focused on educational technology and teacher preparation programs in universities have emphasized integrating technology into the curriculum. America's progress report indicates that 78% of teachers received professional development that focused on the integration of technology in the grade and subject they taught in 1998. However, in too many schools, most teachers and students still use computers only as the equivalent of expensive flash cards or as the tools for drill and practice. The

productivity side of computer use in the general content area curriculum is neglected or underdeveloped (Moursund,1995). With this environment, student teachers have no or little opportunity to integrate technology into the curriculum during the student teaching. In addition, another major problem in student teaching is the isolation. Although student teachers need more help to solve the difficult realities and complexities of classrooms, student teachers are often disconnected from university training, peers, and other classrooms (Schlagal, Trathen and Blanton, 1996).

While many researchers have pointed out some limitations in student teaching, there are several successful student teaching models that have applied learning from universities or tried an innovative approach. As an example, Wetzel (1996) describes the implementation of a project to prepare mentor and student teachers to teach mathematics and science through the integration of multimedia technology. He found that student teachers were better prepared to integrate technology and that mentor teachers changed how they taught mathematics and science. To release student teachers from the isolation of the placement classroom, Schlagal, Trathen and Blanton (1996) suggest the telecommunications that can link members of the student teaching triad. Student teachers can use e-mail to discuss their classrooms with university supervisors and peers in other classrooms.

The project described in this paper addresses three important problems/issues, including: 1) collaboration between student teachers and cooperating teachers, 2) a model for integrating technology into the curriculum, and 3) communication among faculty in higher education, cooperating teachers, and student teachers. The educational technologist provided one-on-one and just-in-time coaching customized to needs in the context/placement classroom for a semester through the whole technology integration process.

Case Study

A case study was used to determine the effectiveness of the proposed mentoring approach for preparing preservice teachers with technology. The participants of this study were two cooperating teachers and a student teacher in an urban school district. These teachers chose to participate in the MIMIC project preparing preservice teachers to integrate technology into their teaching. One cooperating teacher (K) was identified with moderate skills in the use of technology and the other (C) was at the novice level. Both of them have been teaching for more than10 years, mostly at the primary level. Teacher C has worked with student teachers for the last 10 years, Teacher K for 5 years. They currently both teach 2nd grade--all subject areas. The cooperating teachers have been working in collaboration to exchange instructional ideas and resources. They both have laptop computers supplied by the district and have taken a technology class offered by their district. In their school, technology consists of three IBM computers with one printer in each classroom. The software selection is limited to about 15 titles. The student teacher from a major urban university has learned various technology tools through the teacher education program and has developed several lesson activities or material with technology as a course work.

The Planning Phase

In the beginning stage of collaboration, the educational technologist helped two cooperating teachers and the student teacher recognize the various ways in which technology-based activities may be integrated into or transform traditional subject area curricula. To develop an initial plan, the collaboration team including two cooperating teachers, the student teacher, and the educational technologist reviewed technology and science standards in national and local levels such as state, district, and school building. After analyzing the standard, the educational technologist introduced several sample projects that enhance students' learning with technology to help them. During the project, the educational technologist visited the school building on a regular basis (every other week) to support the cooperating teachers' technological skills and to discuss the integration ideas. With assistance of the educational technologist, two cooperating teachers and the student teacher developed an initial plan and timeline for the project. They also discussed an appropriate technology tool and integration methodology that provides more possibilities for students' learning in the placement classroom. HyperStudio was selected as a multimedia instructional design tool for this project. Although HyperStudio was available on three machines in each classroom, many teachers in the school weren't aware of the availability of the software and didn't know how to use it for their teaching.

To choose an appropriate topic for a lesson, the collaboration team outlined all topics which will be taught in the 2nd grade science for the Spring semester. They selected the solar system to be covered at the end of semester

as a major topic for the project for two reasons. First, they needed reasonable amount of time to develop instructional material with their regular routine. Although they received some technology training by their school district, it focused on computer literacy skills rather than context-based activities that can be used to teach curriculum in a subject area. Teacher C expressed that group training through one time workshop was not helpful for novice users like her who need step-by-step guidelines and on-going supports. In addition, since this project was their first experience in instructional design with technology tools, they needed enough time and support to learn many major components in instructional design and as well as technology skills. Second, they thought that the multimedia lesson including images, audio, and animations would be a useful method for students to understand the key concepts of solar system.

The Design Phase

Once a topic and design tools were selected, the collaboration team developed an outline of the lesson unit to teach Space. Through the collaboration work, Teacher K who has moderate skills with technology took the major role in the design process, Teacher C collaborated with K as a subject matter expert, and the student teacher provided just-in-time help to solve technical problems and to improve the instructional material with technology. All participants also relied on e-mail to share work in progress, ideas, and to plan the next steps. The educational technologist provided feedback and suggestions on their work progress through face-to-face meeting or e-mail.

The solar system lesson unit includes one main card and nine sub cards about each planet. The main card including a graphic of nine planets used non-linear design that allowed students to select any topic to learn about our solar system. Each sub card consisted of a planet graphic, the text explanation of an individual planet and voice recording of Teacher K.

The Implementation Phase

Upon completion of the lesson unit, the integration of technology was implemented in the real classroom setting. In the implementation phase, we used Teacher K's classroom which has three IBM computers with headphones and more space for student activities. For the first period, Teacher K taught the solar system lesson unit for her own class for 45 minutes. She provided a workbook including several questions on each planet and divided students into four activities. She set up the computers into three different ways: 1) Solar system created by team, 2) Commercial science program including the solar system, and 3) Internet. The students in pairs explored the solar system on the computer. After exploring the computer for 10 minutes, the students returned to the big group. The students in the big group searched information in reference books prepared by the teacher. Students during this lesson were required to think critically and solve problems through inquiry and collaborative activities. In the second period, Teacher K switched her students with Teacher C's class and used same strategies for the lesson implementation. Teacher K repeated these activities for a week to teach the solar system and gave equal opportunities to all students.

The Evaluation Phase

Two cooperating teachers and a student teacher were observed developing a technology-based instructional material to teach the 2nd grade science and two classes were observed implementing a science lesson using a technology tool during the Spring of 2000. According to Apple Classrooms of Tomorrow (ACOT) study, there are five stages: 1) Entry - learn the basic of using new technology, 2) Adoption - use new technology to support traditional instruction, 3) Adaptation - integrate new technology into traditional classroom practice (usually productivity tools), 4) Appropriation - focus on cooperative, project-based and interdisciplinary work--technology is one of many tools, and 5) Invention-discover new uses for technology tools. Through this project, two cooperating teachers changed their stage before entry or from adoption stages to appropriation stage and the student teacher could apply what she learned in teacher education program in the meaningful and complex context.

During the classroom observations, the researcher wrote comments in her notes that indicated the extent to which the plan, goals, and expectations, as defined in the planning stage, were reached. The researcher also took note of how technology seemed to be influencing the teaching of science. The majority of the students picked up on the main objectives of the lesson and were interacting with other students in the group. Some students needed more

redirection and guidance. In a paired group, students helped and redirected each other so they did not spend any unnecessary time focusing on irrelevant material without the teacher's assistance. Most students were strongly motivated in using computer-based material rather than searching traditional resources.

Discussion

In the beginning of this project, two cooperating teachers pointed out common problems in many professional development programs as following:

- Training occurs in isolated, short, "stand-alone" sessions.
- Training is delivered by non-teachers so that technology and pedagogy are not linked or connected.
- No long-term professional development plan is in place.

Our efforts to overcome these problems were successful. Although a one-to-one mentoring approach may not impact on teacher modeling to larger groups, this approach provided context-based comprehensive training in-depth from needs assessment to evaluation rather than isolated technology literacy skills or a one-day workshop.

Through the technology mentoring collaboration, we found varying degrees of possibilities and limitations to integrate technology into a curriculum. The limitations were related to the instructional time, teachers' preparation time, limited access to equipment or software, and administrative support. The possibilities could be increased by teachers' willingness and collaboration with peers or educational technologists. Most importantly, the project produced very positive results on students' learning with technology in the classroom. Also a one-to-one mentoring collaboration model to integrate technology into curriculum can easily be conducted among cooperating teachers and student teachers at any school site. According to Knapp and Glenn (1996), the process of educating teachers must include both academic practice, and practical knowledge and skill gained only by working in actual schools and classrooms with experienced educators. Therefore, teacher preparation must involve collaboration between the two sites of the university and the school.

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The Integration of Technology into Classroom Lessons in the Teacher Preparation Program at the University of Houston-Clear Lake

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Abstract: This paper describes the successful development of a one-year capacity building grant funded by the U. S. Department of Education's Preparing Tomorrow's Teachers to use Technology (PT3) program. The focus of the grant was to prepare teacher candidates to become proficient in developing and delivering classroom lessons that effectively incorporate technology in the learning process so that all students (Pre-kindergarten to 12th grade) use technology in demonstrating mastery of lesson plan objectives. Qualitative and quantitative results indicate that the preparation model has been successful with teacher candidates becoming proficient in developing and delivering technology-integrated lesson plans. Moreover, participants' (i.e., teacher candidates, mentor-teachers, and university faculty) comfort level with technology and frequency of technology usage has increased.

The Lack of Technology Integration within the Curriculum is a Nationwide Issue

In elementary and secondary schools throughout the United States, the ability to incorporate technology within the curriculum is one of the most difficult tasks for teachers (Benton Foundation, 1997; Driskell, 1999). Teachers' lack of familiarity with varieties of technological hardware and software appropriate for curriculum integration has contributed to this development (U. S. Congress, Office of Technology Assessment, 1995). Trotter (1997) indicates that while teachers may have received sufficient preparation with content and pedagogy, they have not been sufficiently prepared to exercise technology within teaching; thus, creating a huge bottleneck in the use of computers in the nation's classrooms (Benton Foundation, 1997).

Technology Literacy is a National Mandate

Research studies indicate that technology can serve to positively impact student learning in terms of academic achievement, skill development, and attitude toward school attendance (Kane, 1994; Kulik & Kulik, 1991; Kulik, Kulik, & Bangert-Drowns, 1985; Pisapia & Perlman, 1992). Technology in the classroom serves as a tool to develop students' critical thinking, resourcefulness, and collaborative skills as well as to improve students' self-concept and attitude toward learning, and to increase student/teacher interaction (U.S. Congress, Office of Technology Assessment, 1995). Technology literacy for all students is a national mandate of the United States (U.S. Department of Education, 1997). An increasing number of educators and technologists believe that computer and communication technologies can provide a vehicle to help facilitate the evolution of a new education system to provide more accessible, higher-quality learning opportunities for everyone (Hunter, 1993).

Teacher Education Programs Need to Provide Technology Integration Preparation

University and college teacher education programs continue to produce teachers who do not possess the skills to integrate technology within the curriculum. Only eighteen states require technology preparation as part of their teacher certification program (NEA, 1997). The 1998 report, *Technology and the New Professional Teacher: Preparing for the 21st Century Classroom*, commissioned by the National Council for Accreditation of Teacher Education (NCATE) strongly urges schools of education to prepare future teachers in the use of technology in the classroom (Driskell, 1999). The NCATE includes in its accreditation review process of teacher education programs a set of twelve national standards for educational technology as developed by the International Society for Technology in Education (1992). The sixth standard directly relates to the integration of technology in the curriculum stating, "Evaluate, select, and integrate computer technology-based instruction in the curriculum of one's subject area(s) and/or grade level(s)" (Driskell, 1999, p. 121).

Technology Integration Strengthened in UHCL Teacher Education Program

The University of Houston-Clear Lake (UHCL) in partnership with eight rural and urban school districts in the Houston, Texas area has established a successful, field-based teacher preparation program. The University of Houston-Clear Lake (UHCL) is an upper-level university, i.e., junior and senior and graduate level students. UHCL has an enrollment of approximately 7,500 students, and serves the academic and professional needs of regional students, as well as national and international students. UHCL is accredited by The Commission on Colleges of the Southern Association of Colleges and Schools (SACS), the National Council for Accreditation of Teacher Education (NCATE), and the Texas State Board for Educator Certification (SBEC). The UHCL School of Education has earned one of the highest cumulative pass rates on the statewide test for teacher certification with a pass rate of 97.2% (1997-1998).

While a collaborative, field-based teacher education program has been effectively developed at the University of Houston-Clear Lake with teacher candidates receiving technology education linked to standards, teacher candidates still needed specific preparation to integrate technology within the curriculum. The United States Department of Education's Preparing Tomorrow's Teachers to use Technology (PT3) grant application process provided the impetus to review the technology preparation of teacher candidates at UHCL. The first step in the review (grant development) process was to assess the current teacher education program components in light of the research on technology integration within the curriculum, specifically the ten factors for technology integration.

Ten Factors for Technology Integration within the Curriculum

For integration of technology to occur within the curriculum, ten factors need to be incorporated in a professional teacher preparation program (Driskell, 1999). The ten factors include (1) access to technology tools; (2) technology training; (3) pedagogy behind effective integration of technology; (4) assessment of teacher candidates' skills using technology effectively in the classroom; (5) models that demonstrate the integration of technology within the curriculum; (6) incentives for teacher candidates to integrate technology within the curriculum; (7) time for teacher candidates to learn about and plan for technology use; (8) school climate that encourages use of technology resources in innovative ways; (9) collaboration among teachers (teacher candidates and mentors) about technology integration; and (10) technology integration support.

Analysis of Factors in the UHCL Teacher Preparation Program: Identifying Specific Gaps

In analyzing the current teacher candidates' preparation in technology at UHCL, four of the ten factors were being directly met: (1) access to technology tools; (2) technology training; (3) pedagogy behind effective integration of technology; and (4) assessment of teacher candidates' skills using technology effectively in the classroom. These four factors were being addressed through a technology course entitled "Computer Use in the Classrooms" (INST 3133). Although receiving technology preparation, teacher candidates were not developing and delivering lesson plans that effectively incorporate technology in the learning process (following an assessment rubric) so that classroom students (Pre-kindergarten to 12th grade) used technology to demonstrate mastery of lesson plan objectives. Three major gaps were identified in the technology preparation of teacher candidates.

Gap #1: Integration and Modeling by Faculty

Authentic lesson plans with technology integration are not specifically taught in any class at this time. Education faculty members, some of whom are part-time, teach lesson plan development and delivery, but not the integration of technology within lesson plans, including technology standards, e.g., International Society for Technology in Education (ISTE) Standards. While able to use technology, most faculty members are not proficient in the integration of technology within the curriculum. Consequently, many of their course syllabi do not include this requirement. In addition, the technology course entitled "Computer Use in the Classrooms" (INST 3133), a required course for teacher candidates, focuses more on technology skills development than on technology integration within lesson plans. Most sections of the course are taught by part-time faculty some of whom have not been classroom teachers, thus, have little or no experience in developing lesson plans. Because of this gap, some factors are not being addressed: (5) models that demonstrate the integration of technology within the curriculum; (6) incentives for teacher candidates to integrate technology within the curriculum; (7) time for teacher candidates to learn about and plan for technology use.

Gap #2: Field Placement of Teacher Candidates

Teacher candidates are not necessarily placed with mentor-teachers proficient with technology. While mentor-teachers have extensive teaching experience, many of them have not received the necessary technology education to model technology usage and integration. While experienced teachers participate in mentoring training to become mentor-teachers, they are not required to participate in a technology education program. Moreover, most school districts do not have sufficient resources to provide technology education to classroom teachers, much less in a specific area of technology integration within the curriculum. Because of this gap, a couple of factors are not being addressed: (8) school climate that encourages use of technology resources in innovative ways and (9) collaboration among teachers (teacher candidates and mentors) about technology integration.

Gap #3: Support System

Teacher candidates do not have ready access to an established support system at the university and campus levels that provide assistance in technology integration. While individual faculty members and campus teachers may have knowledge of technology integration, teacher candidates do not have ready access to these resources. Moreover, university faculty and campus teachers are unaware of teacher candidates' technology needs. No central clearinghouse component exists, e.g., Web site, that provides names and addresses of resource people at both the campus and university levels, as well as allows teacher candidates to ask questions and find models of lesson plans. Because of this gap, (10) technology integration support is not being addressed.

Development of Lessons Plans to Demonstrate Technology Integration within the Curriculum

Once the assessment phase was completed and needs (gaps) identified, then, objectives and strategies were developed to address current needs. The objective of the grant proposal was to develop a program model that addressed the factors in preparing successful teacher candidates to integrate technology within the curriculum, specifically, in classroom lesson plans.

The central proof of a teacher's ability to effectively incorporate technology within the curriculum is the development and delivery of classroom lesson plans that integrate technology. The implementation of these lesson plans will result in classroom students (Pre-kindergarten to 12th grade) using technology to develop products that demonstrate mastery of lesson plan objectives. To become proficient in lesson plan development, teacher candidates need preparation in two areas. The first need is in the application of various types of technologies, e.g., computers and computer software appropriate for classroom use. Second, they need the ability to compose lesson plans that incorporate the appropriate technology within the curriculum for student application. The central strategy in addressing these two needs is the development of an interactive professional development technology practicum.

An Interactive Professional Development Technology Practicum

After receiving a one-year PT3 capacity building grant, the UHCL Collaborative developed a three-day, interactive professional development technology practicum to prepare teacher candidates to develop and deliver lesson plans that integrated technology within the curriculum. The practicum included the following components: (a) vision of student-centered technology-rich classroom environments, (b) technology integration with one (few)

computers in a classroom, (c) guidance of students in creating successful multimedia presentations using multimedia software, (d) guidance of students to use higher order thinking skills in technology use, (e) use of electronic educational templates, (f) technology and performance standards in a lesson plan, (g) development of student electronic, journals, book reports, and technology portfolios, (h) guidance of students in researching on the Internet and (i) effective uses of telecommunication tools in education. The practicum also addressed the needs of economically disadvantaged campuses. For novice computer operators only, an additional one-day basic technology skills session was provided prior to the three-day technology practicum.

Teacher candidates, along with their mentor-teachers and university faculty, became proficient in the application of technologies and gained understanding of the pedagogy behind the specific technology's usage, and collaboratively developed authentic lesson plans that integrated technology following a designed lesson plan template. Lesson plans were assessed for appropriateness and completeness using a designed lesson plan rubric. Teacher candidates delivered their lesson plans to classroom students (Pre-kindergarten to 12th grade) and student developed products (using technology applications) that demonstrated mastery of lesson plan objectives. The technology consultant and project evaluator assessed student products for relevance and completeness. This developmental process allowed teacher candidates to assess their own progress in developing and delivering technology-integrated lesson plans, as well as to improve their delivered lesson plans. Teacher candidates published their lesson plans on the Project's Web site.

After completing the three-day professional development technology practicum, participants were provided ongoing professional support via the Project's Web site as they developed and delivered lesson plans in the classroom. Ongoing professional support for participants is a critical element of success (Brooks, & Kopp, 1989; International Society for Technology in Education, 1992; Benton Foundation, 1997), especially in a constructivist learning environment (Wilson, 1996). The interactive professional development technology practicum was successful in addressing the ten factors (See Fig. 1 below) that effect the integration of technology within the curriculum.

Figure 1: How Practicum Addresses the Ten Factors for Successful Technology Integration

(1) Access to technology tools	Technology training matched the technology tools available at teacher participants' campuses.
(2) Technology training	The grant provided 18 hours of hands-on technology training linked to the state technology standards.
(3) Pedagogy behind effective integration of technology	Understanding the most effective method for integration of technology was a focus for the training for teachers.
(4) Assessment of teacher candidates' skills using technology effectively in the classroom	Each participant received assessment reviews for their lesson plans.
(5) Models that demonstrate the integration of technology within the curriculum	Model lesson plans were accessed through the Project' Web site, as well on other Web sites.
(6) Incentives for teacher candidates to integrate technology within the curriculum	Incentives were given to each campus that participated in the grant project.
(7) Time for teacher candidates to learn about and plan for technology use	Grant participants were provided time to ask questions and experiment with various new technology skills and knowledge components during training sessions.
(8) School climate that encourages use of technology resources in innovative ways	Administrators endorsing this grant effort promoted the teacher's technology use with students.
(9) Collaboration among teachers (teacher candidates and mentors) about technology integration	Working together to share and ask questions was a major component of the grant. Collaboration occurred by telementoring as well as face-to-face during the training.
(10) Technology integration support	Each teacher had follow-up technology support from the university and campus levels.

Evaluation of the One-Year Capacity Building Study

The methods of evaluation provided performance feedback and permitted periodic assessment of progress toward achieving intended outcomes (Erlandson, Harris, Skipper, & Allen, 1993). The participants in this capacity building study represented three groups: teacher candidates, mentor-teachers, and university faculty. Participants attended training sessions to assist them in developing lesson plans with appropriate technology that met established standards.

At the beginning of the first session, participants completed three locally developed instruments designed to document areas where change was expected over the course of the training. The instruments included a Technology Comfort Scale, a Frequency of Involvement in Technology Scale, and an Attitude Toward Technology Scale. The scales were determined to have a Cronbach's alpha reliability coefficient of .91, .95, and .98, respectively. The magnitude of these coefficients indicates good scale reliability for each of the three scales.

In this capacity building study, thirteen teacher candidates, twenty mentor-teachers, and six university faculty participated in the practicum to become proficient with the application of various types of technologies for classroom use and to develop lesson plans. The training consultant guided the participants through exercises designed to gain proficiency with various technologies. Teacher candidates demonstrated their ability to develop lesson plans that integrated technology to meet established standards. The technology consultant used a scoring rubric to assess the successful construction of lesson plans that integrated technology. With feedback and assistance from the consultant, teacher candidates developed lesson plans that included components required for proficiency.

At the end of the third day of training, participants were tested a second time using the same instruments as exercised at the beginning of the practicum. This method allowed for a pretest/posttest comparison to demonstrate change during the project. The training days were not sequential, which allowed participants to return to their classrooms to use skills learned prior to the beginning of the next session.

The teacher candidates gained an average of slightly more than 8 points on their level of comfort with technology. However, by the end of the three days of training, the rating of frequency at which they were using various aspects of technology had increased approximately 5 points. The positive attitude of the teacher candidates toward technology increased by about 1 point by the end of the practicum.

The mentor-teachers gained an average of slightly more than 1 point on their level of comfort with technology. However, by the end of the three days of training, the rating of frequency at which they were using various aspects of technology had increased by nearly 7 points. The positive attitude of the mentor-teachers toward technology increased approximately 2 points by the end of the practicum.

The university faculty gained an average of slightly more than 12 points on their level of comfort with technology. However, by the end of the three days of training, the rating of frequency at which they were using various aspects of technology had increased by nearly 13 points. The positive attitude of the university faculty toward technology increased by approximately 2 points by the end of the practicum.

In each case, the gain in positive attitude was minimal; however, the positive attitudes toward technology in each group were very high from the beginning of the study, and this most likely accounts for the lack of change. Additionally, since each of the groups was relatively small (thirteen teacher candidates and six university faculty) the documentation of any change should be considered a success. It would be useful to gauge these developments with a larger sample over a longer period of time (longitudinal study) to analyze whether similar results occur.

In addition to the quantitative approach described above, samples of classroom student work (the results of teacher candidates' delivery of lesson plans) were reviewed using the scoring rubric developed by the training consultant. The lesson plans were found to contain the required elements indicating that teacher candidates had effectively integrated technology into their teaching and that classroom students were using technology in demonstrating mastery of lesson plan objectives. Examples of student work were placed on the Project's Web site.

Conclusion

During this one-year, PT3 capacity building study, teacher candidates, mentor-teachers, and university faculty participated in developing a program model to prepare teacher candidates in integrating technology within the curriculum. This process took the form of developing and delivering lesson plans that integrate technology so that all students (Pre-kindergarten to 12th grade) use technology to demonstrate mastery of lesson plan objectives. Qualitative and quantitative results indicate that the preparation model has been successful in preparing teacher candidates to become proficient in technology integration and that participants' comfort level with technology and frequency of technology usage had increased.

Along with addressing the ten factors for technology integration within the curriculum, this educational process developed the three agendas for school reform in the information age. These agendas include (a) developing agreement about learning and teaching, (b) integrating technology, and (c) restructuring (Mehlinger, 1996). Participants discussed the pedagogical process of integrating technology in classroom lesson plans with developmentally appropriate hardware and software, during which process they became more confident and competent in using technology applications. In this developmental process, participants were describing ways to restructure learning in the classroom, making it more active, and student-oriented. As one principal in the UHCL Collaborative declared, "The operations of this grant has moved our school into a new century."

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Preparing Today's Faculty to Prepare Tomorrow's Teachers to Use Technology: Lessons from a PT3 Project

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Abstract: Three types of data were obtained in order to objectively determine faculty development needs in the area of technology in teacher education. On the basis of the data it was determined that most members of the faculty needed to acquire specific skills and knowledge about generic technology tools, about subject specific technology applications and about creating technology based activities or products for incorporation into teacher education courses. A Technology Learning Team model of faculty development was created.

This paper provides a description of an ongoing PT3 project at a comprehensive teacher education institution. The primary focus of the project is to provide faculty development in knowledge and skills to infuse technology into courses across the teacher education curriculum. The paper will describe 1) the steps taken to objectively identify faculty development needs, 2) the strategies developed to effectively respond to these needs, 3) the resources, in addition to those provided by PT3, necessary for successful implementation of this PT3 grant, 4) the obstacles encountered in the initial implementation of the grant, 5) the solutions developed to overcome these obstacles, and 6) recommendations for comparable institutions engaging in similar activities.

I. The steps taken to objectively identify faculty development needs.

Three types of data were gathered: 1) a survey of faculty based on a modified version of the School Hardware Technology Survey (Edmin Open, 1998), 2) data from faculty focus groups, and 3) a rating of the faculty on the Ohio SchoolNet Professional Development Matrices (Ohio SchoolNet, version 1). These data revealed that all full-time faculty members who completed the survey (n=31) have a computer in their office. Data from the Office of the Dean further indicated that all full-time members of the faculty have been assigned an office computer. Two thirds of the surveyed group have a computer that is Internet capable and most have machines that are CM-ROM capable. While all have either an ink-jet or laser printer, their access to other devices, such as scanners or digital cameras is low (less than 10%). Faculty access to technology in classrooms is less frequent. Aside from a computer workstation in the math methods classroom, few classrooms are equipped with audio/visual equipment such as overhead projectors and VCRs with monitors. Such equipment can be reserved from a central audio/visual department for use in class. However, this is a relatively cumbersome process involving the transportation of the equipment from a different building on a 3-building vertical campus.

Only one member of the faculty was specifically hired to teach in the area of technology. Two additional members of the faculty include technology as a major area of their expertise, but were not hired on technology faculty lines. The following can be said of the technology skills of the faculty in relation to the Ohio SchoolNet Professional Development Matrices, which rate technology skills in the areas of productivity, information, network, and hypermedia tools.

Approximately 6% of faculty members are at the expert level across the four areas. (These are 3 faculty members described above). Most faculty members are at the "novice" or building capacity level in 3 of the 4 areas. About 25% of faculty members are at the "practitioner" level in at least one technology tool. (In general practitioners adopt models of technology and apply them to specific curricular lessons or units).
The most common uses of technology by faculty are word processing and accessing e-mail. About 65% report using e-mail; 39% have developed web-based activities, mainly, posting course syllabi on the Web; 4 have online chat rooms that serve as an integral part of their courses.

II. Strategies developed in response to the needs identified by the faculty.

These include faculty, staff, and mentor teacher development workshops as well as significant improvement in a range of technology hardware. The hardware, which was not provided by the PT3 grant, is discussed in Section III, below. The development activities consist of placing all of the faculty, staff, and mentor teachers, in cohorts of approximately 20 each semester, into Technology Learning Teams (TLT). Each TLT comprises four to six participants, consisting of a cross section of individuals from the above groups. The focus of each team is on using technology as a teaching-learning tool, and on integrating this tool function into instruction in a content area of interest or relevance to team members. (For non-teaching staff the focus is on the support services they provide). The TLTs work with external consultants with expertise in technology knowledge and skill development and their application to teaching and with unique collections and resources in the arts. The latter is an area of interest to a significant number of faculty members who have recently worked to incorporate art across the teacher education curriculum. The role of the consultants is to provide workshops and serve as facilitators to help TLT members achieve the following objectives:

- Acquire specific skills and knowledge about generic technology tools.
- Acquire knowledge about subject specific technology applications.
- Create learning activities or products that incorporate technology or that are technology-based.
- Assess the impact of the product or activity on learning in a course or in a classroom.
- Provide unique collections of resource materials and pedagogical practices.
- Assist in the development of meaningful, effective and creative ways of combining these with technology.

The TLT staff development model consists of 4 phases each consisting of principal objective and method for achieving it.
Phase 1: The acquisition of skills in a technology tool domain through modules/workshops conducted by expert consultants.
Phase 2: The design and development of technology products or activities for use in a course for pre-service teacher candidates.
Phase 3: The incorporation of developed technology products or activities

produced into courses for pre-service teacher candidates and into student support services.
Phase 4: The evaluation of the effectiveness of the implementation of the technology products.

III. The resources, in addition to those provided by PT3, necessary for successful implementation of PT3.

Since PT3 did not provide significant resources for the purchase of hardware, and required evidence institutional capacity in this area, funds provided by the college's administration, and foundation grant support were necessary. Evidence of the institutions capacity building include:

- Ongoing replacement of outdated computers in faculty offices (25 new or refurbished PCs received in last 2 years, with additional ones due next year)

- Renovation of the computer laboratory with 24 networked computers and a teacher workstation controlling all multimedia functions

- Creation of a "Smart Classroom", with a high-end presentation, hypermedia workstation (Internet-access, satellite feed, VCR, computer input and audio system)

- Creation of a multifunctional, multimedia conference room with video streaming capability opening a cyber window between the college and several public schools that serve as field sites for teacher education candidates

- Acquisition, through a state grant, of a set of laptops for the Teaching English to Speakers of Other Languages (TESOL) Program

IV. Obstacles in the initial implementation.
The obstacles that were encountered were of several different varieties: 1) facilities; 2) prior faculty commitments; and 3) competing grant-funded activities. Within the area of facilities, delays in the construction of the adjacent space for the "smart classroom" and the education technology lab, prevented theses two facilities from being on-line during the fall 2000. The demand for other technology facilities on campus by other faculty members, students and administration resulted in a delay of the technology skill development workshops. Alternative arrangements had to be made to provide facilities for the required technology-based courses in our various programs.

Faculty selected for Cohort 1 were not available to participate in the proposed technology training during the Fall 2000 semester because of required participation in the state-mandated redesign and reregistration of every teacher education program in the School of Education. Approximately, 40 programs had to undergo redesign in light of new certification requirements. Moreover, faculty who had administrative responsibilities as program coordinators, about a dozen faculty members, were restricted in the amount of additional released time from teaching that they could receive during any given academic years. As program coordinators, these faculty members had additional responsibilities during the program reregistration process.

Finally, additional grant opportunities threatened the faculty eligible to participate and receive the prescribed incentives from the PT3 initiative. Theses grants include federal and state training grants and school district grants to support school reform and curricular change initiatives. In particular, a university-wide technology grant to support distance learning was

received at the start of the fall semester. Faculty were offered a substantial cash incentive for participation in that initiative and many faculty from HCSE applied for this opportunity.

V. The solutions developed to overcome these obstacles.

The solutions that were developed were varied and also were designed to support the goal of faculty development of course-related technology skills that would directly impact the instructional environment of the teacher candidates.

1. There were no alternatives to the lack of needed facilities so the technology workshops were postponed until 2001.
2. The highest priority in HCSE was the completion of the reregistration process. Thus, there was another reason, in addition, to the lack of available facilities to delay the start of the project.
3. With the help of the Dean of the HCSE and the project staff, a group of faculty were selected who would serve as pivotal individuals within programs or disciplinary areas and were invited to participate in the project. The nominations were made in light of existing commitments to grants and administrative responsibilities. Faculty members, who had applied for the university-wide technology grant, were not included in the current project initial cohort.

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Critical Approaches to Technological Literacy and Language Education

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Abstract: When we integrate technology into teaching and learning, our challenge is to imagine and enact technology-rich learning environments in which both teachers and students can succeed in ways that technicians and administrators can sustain. We suggest three approaches to designing such environments; each approach is useful at a different level of specificity. In the classroom, technology autobiographies help teachers learn about their students' technological backgrounds and capabilities. At the institutional level, a "multiculturalism" metaphor helps teachers and administrators imagine locally appropriate models of technology support. In the context of pre-service and in-service teacher education, a heuristic we've developed encourages critical reflection by teachers as they learn and implement new technologies.

Background

Teachers are using technology more frequently than ever before as schools try to respond to student needs and get in step with new federal and state computer literacy initiatives. Yet, technology in the classroom does not exist for its own sake: It exists to support teaching and learning. When we teach with technology, we consider ourselves remiss if we don't first establish expectations for student learning, and then build in technologies that can help us to enact those expectations. Yet, for students to learn and for teachers to teach, complex technological systems must work smoothly. Moreover, teachers must learn how to teach with technology and how to use technology to facilitate scholarly and administrative work.

However, in many cases, computers, training, and curricular implementation occur concurrently, as schools hasten to meet student needs and administrative mandates. Teachers are left scrambling, striving to retool with complex new skills while simultaneously revamping their teaching strategies. Individual teaching styles, content parameters, institutional constraints, and student characteristics all compete for teachers' attention. Meanwhile, administrators, eager to implement technological enhancements to curricula, struggle to fund the support systems that teachers so desperately need. Critical reflection on the entire system, not unexpectedly, often takes a back seat in such a chaotic environment. But it doesn't have to. In our on-going struggles to imagine and enact technology-rich learning environments, we have employed several strategies that appear to allow teachers and students to succeed in a way that technicians and administrators can sustain.

One of the problems is that students—who often possess the technological skills that teachers need to learn—are trapped with teachers in an inflexible model of education. In a familiar pattern of learning and power dynamics that Margaret Mead (1970) called postfigurative learning, students learn while teachers teach. Although outside of school, the larger technoculture relies heavily on cofigurative or peer-to-peer learning and on prefigurative learning, in which the young teach the old (Mead 1970), when it comes to schooling, we are stuck in a post-figurative mode of operation in which older citizens teach younger citizens. The challenge we face as technology-using teachers and administrators is to find ways to tap into technological knowledge wherever it resides and subsequently make it possible to distribute that knowledge throughout our institutions

wherever it is needed. This sharing can be accomplished at the level of the classroom or institution, and it can be addressed in pre-service or in-service teacher education.

Starting in the Classroom: Technology Autobiographies

Teachers of writing often find that asking students to consider the history of their literacy practices, early memories of reading and writing, and the writing and literacy expectations of their parents and teachers can help reveal the personal—and oftentimes unspoken—contexts that students bring to the classroom. Accordingly, literacy autobiographies are sometimes employed as a way for students to write about and reflect on those memories. Similarly, technology autobiographies can be assigned in many types of classes to help teachers understand the experiences with and attitudes toward technology that students bring with them to the classroom.

We have become convinced of the value and usefulness of assigning technology autobiographies in a variety of classes for several reasons. First, and perhaps most obviously, we already know—though it's seldom mentioned in the context of literacy education, and academics understand it only at surface levels—that students are entering our classrooms with sophisticated technological literacy skills and charged attitudes toward technologies (Mead 1970; Tapscott 1998). We think of students as the users of educational environments and consider ourselves to be the primary designers of such environments. With technical communication scholar Robert Johnson, we believe that designers of systems are "obliged to learn how to value, how to see, the knowledge that users produce and then to learn how to make this knowledge an integral part of the technologies we use" (Johnson 1998). As teachers, then, we need to know more, and know more intimately, what is behind the literacy skills and attitudes that students bring to our classroom.

Secondly, we have observed that teachers work within an increasingly complex system of *technologies within technologies*. By that we mean that on one level, teachers are important stakeholders in the construction of systems of teaching and learning, systems that we have come to regard as technologies (Johnson). Teachers' objectives for teaching and learning may vary considerably, but we all start out with the intention of creating learning systems or environments for students that will also function effectively within the social systems or institutions within which we work. In our efforts to accommodate these institutions, we attend to influences on the technology of teaching and learning. Included among these influences are the efforts of curriculum committees, institutional missions and values, budgets, building layouts, time schedules, purchasing conventions, the abilities of support personnel, administrators' needs, the work of state and national professional organizations, and our own intellectual interests and physical capabilities.

Increasingly, teachers attend as well to a range of electronic systems that influence and complicate course and curriculum planning. Such electronic systems make up another set of technologies within the technology of teaching and learning. As we construct classes (or, more accurately, construct learning and teaching environments), we often have the opportunity to decide whether—and how—to incorporate technologies. Teachers no longer simply design classes and lesson plans: they are the architects of technologies of teaching and learning. Teachers don't just use tools. They construct learning environments in which they and their students live for a time.

A third reason for our interest in assigning students to write technology autobiographies has to do with the fact that teachers think of themselves as creators of courses and curriculum, just as engineers think of themselves as creators of cars and the other mundane artifacts of our culture. However, teachers usually work alone on the design of teaching and learning technologies, influenced, of course, by the particular institutional environments in which we work. In contrast, engineers usually work as productive partners in development teams. We don't dispute that teachers should adopt the label of creator and curriculum designer: this designation certainly makes clearer our responsibilities to the students with whom we share the learning environments that we create. It is, however, not enough for teachers to imagine themselves as creators. They must also acknowledge the needs and values of the people for whom they create teaching and learning spaces and incorporate such needs and values into the curriculum design process.

Armed with the rich data to be found in technology autobiographies, teachers can begin to draw on the strengths their students bring to the classroom. Technology autobiographies also enable teachers to map changes in students' attention and aptitudes over time, thereby helping them to understand technocultural changes at a very localized and specific level. In some regions, technology autobiographies may reveal deep-seated inequities among student populations and suggest learning outcomes that are not measurable with standard assessment tools. For example, some students' technology autobiographies demonstrate that problem-solving and collaboration skills can be learned by playing video and computer games. Others illuminate the types of risk-taking behaviors that often accompany technological success. These learned behaviors—stemming from early and prolonged exposure to complex, fast-paced, and highly interactive technologies—can suggest curricular innovations that build on what has already worked for these students.

Locally Appropriate Technology Support Systems: the Multiculturalism Metaphor

As technology has become simultaneously more complicated and more ubiquitous, departments have begun to hire specialists to support the integration of technology into curricula, classrooms, and research contexts. Sometimes, a faculty member or librarian takes on the role of technology specialist. But a number of schools at all levels are hiring professional staff members to support technology, rather than assigning the task to tenured or tenure-track faculty.

Schools don't really know how to integrate these new types of employees. They have professional credentials, yet they are not teachers. Paradoxically, though, they *teach* the teachers, who, in turn, are charged with teaching the students. In an apt metaphor, technology specialists are rather like "foreigners"; they are "different, outsiders visiting the territory of other disciplines, and their interaction with the local residents helps to bring about change" (McLeod 1995). McLeod was writing about directors of Writing Across the Curriculum (WAC) programs, but her characterization of the foreigner roles played by technology specialists is right on target. Similarly, Julia Kristeva discusses the fleeting and sporadic nature of interactions with foreigners. She notes that it is considered exceptional when a foreigner has something to teach the natives. Moreover, once the foreigner's purpose has been accomplished, he or she is expected to "depart, as a friend taking leave of friends, and be honored by them with gifts and suitable tributes of respect" (Kristeva 1991). In other words, a foreigner's stay is expected to be short-lived, to last only as long as he or she is contributing something to the community or at least is not poaching excessively on the community's resources.

McLeod (1995) outlined five short-lived foreigner roles that WAC directors sometimes adopt. These five roles are similar to roles that technology support specialists may assume—briefly—within academic departments. **Conquerors** impose programs from above. When a technology specialist acts as a conqueror, technology becomes "something done *to* rather than *with* faculty." Because imposing a program from above can position the technology support person as "the tool of an insensitive, even hostile administration," the practice often engenders faculty "defensiveness" and "active resistance." **Diplomats** are emissaries from one department to another. Often, these emissaries come from the central computing organization, and, although they may have the best intentions, nonetheless represent their departments' interests. Ultimately, diplomats perpetuate the idea that technology is the purview of the technology department, not the English department. **Peace Corps volunteers** tend to regard technology development as a kind of selfless service. They "work for the sheer love of it," requiring "no released time, no funding for workshops, no administrative support." **Missionaries** "go forth to convert," armed with the conviction that their "particular beliefs and practices are superior to all others." Their goal is one-dimensional: "to teach their own views as the correct ones." **Change agents**, which McLeod regards as the least objectionable of the five foreigner roles, couple an "unfamiliarity with and respect for the local culture" with a "willingness to listen and learn from that culture" that makes them "appealing visitors." They regard their own knowledge as something to be discussed and perhaps broadened through dialogue (McLeod 1995).

Each of these foreigner roles can be used to accomplish specific goals, but no single role can or should stand alone as a unified approach to departmental technology support, because each has its dangers and limitations. What I submit may be more effective is a "multicultural" approach to technology support, in which the technology specialist—still the foreigner in many educational contexts—assumes different roles as needed: diplomat, Peace Corps volunteer, missionary, and change agent. In addition, faculty, staff, and students who

work with technology within the school or department also take on roles and responsibilities, regardless of their discipline or field of expertise, adding to the multicultural atmosphere.

A paradox faced by foreigners is that to change the system, they need to be integrated into it. That is, they need either to attain some respectable level of power or to establish a significant degree of engagement with the system. In short, they need to feel some connection to the system and to care about what happens to it. Engagement and power cannot easily be attained within alien turf, but if we construct educational environments as "borderlands," following Gloria Anzaldúa, we may be able to understand why some technology specialists, despite being "foreigners," are able to become engaged and to exert power. Borderlands are "physical places where two or more cultures edge each other, where people of different races occupy the same territory, where ... the space between two individuals shrinks with intimacy." They are "place[s] of contradiction," where it is difficult to keep intact "one's shifting and multiple identity and integrity." But they are also places of "exhilaration." Because the border dweller or *mestiza* lives constantly in the midst of contention, discomfort, and alien-ness, he or she is a "participant in the further evolution of humankind" (Anzaldúa 1987).

When technology specialists join departments, a kind of borderland is created. Both faculty and technology specialists at first experience some of that discomfort with which Anzaldúa is so familiar. The owners of the turf—the faculty—may feel threatened, both by the presence of a newcomer and by the prospect of using computer technology to support and even to deliver their courses. As a result, the technology specialist may feel at odds and unwelcome. Anzaldúa writes, "The coming together of two self-consistent but habitually incompatible frames of reference causes... a cultural collision." In its most unproductive form, such a collision may result in a metaphorical standoff or duel that ends when the newcomer, the technology specialist, "decides to disengage from the dominant culture, write it off altogether as a lost cause, and cross the border into a wholly new and separate territory." Anzaldúa advocates a different course of action: instead of disengaging, she suggests that border-dwellers can survive best if they "shift out of habitual formations" and move "toward a more whole perspective, one that includes rather than excludes." Border dwellers cope, in short, by "developing a tolerance for contradictions." They operate not in a dualistic but in a pluralistic mode—"nothing is thrust out, nothing abandoned" (Anzaldúa 1987).

In a technology-rich educational environment, everyone—not only technology specialists, but also teachers, students, and administrators—dwells on the border. Like the *mestiza*, the most successful border-dwellers "straddle two or more cultures," willing to be "vulnerable to foreign ways," to give up safety and familiarity. The *mestiza* consciousness turns border-dwellers from foreigners to multicultural shape-shifters, available to move in and out of relevant roles as needed (Anzaldúa 1987).

Thinking Critically About Technology: Pre-Service and In-Service Teacher Education

A heuristic for critical reflection on technology would encourage teachers to become local technological activists (as opposed simply to technological advocates). Specifically, our heuristic suggests that those who teach with technology should attend to "infrastructure": the material, institutional, and human conditions that surround their classes, students, and instructional effort. Part of any technology activist's job is to help set up institutional infrastructures that facilitate the design of productive technology-rich systems. In addition, because technological systems are already in place in many institutions, the technology activist must understand how to influence existing systems.

We should expect a critical technologically literate activist, then, to take a three-pronged approach:

1. Learn as much as possible about how technologies influence literacy practices;
2. Determine which practices are worth encouraging; and
3. Finally, learn how to help sustain those practices over time and across the social spectrum, or "digital divide."

Technological activism is a state of mind, an attitude toward the important work we do as educators. With that state of mind, even overworked teachers, technicians, and administrators can accomplish a great deal if they distribute their efforts over many years.

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Evolution of an Online Data Acquisition System

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Abstract: The evolution of online data collection systems implemented by the Preparing Tomorrow's Teachers to Use Technology (PT3) Millennium Project team (US Dept. of Ed. Capacity Building Grant # P342A990474) during the 1999-2000 school year is described. Examples of the software and survey instruments, database structures, and feedback systems that were initially developed as well as those which are now in place are presented. Participants can access and complete surveys on an experimental system that provides immediate educator feedback by graphing profiles of their responses against the database norm.

Introduction

Paper-based surveys are often expensive, time-consuming, and cumbersome ways to gather data required for evaluation or assessment of project activities. Many projects have moved away from paper surveys to web-based acquisition of data from teachers and students. This paper covers alternatives explored by members of the U.S. Department of Education project team for The Millennium Project: Pathways for Preparing Tomorrow's Teachers to Use Technology. The paper addresses survey procedures and instruments, database structures, and feedback systems which are now in place on servers at the University of North Texas. Plans for merging the PT3 system with a similar one needed for a U.S. Dept. of Education Technology Innovation Challenge Grant evaluation are described as well.

Online data acquisition alternatives

Paper surveys. Paper-based surveys have been the traditional method of gathering responses for many decades. For many populations, such as young children, paper continues to be the most viable alternative because paper surveys require little or no special technology to administer or complete and can be tallied by hand. The method is familiar and fault tolerant. However, it is also labor-intensive and time-consuming for large volume applications. A decision about whether or not to use paper is often strongly influenced by the accessibility of online submission technology for respondents and whether or not there is a time critical need for mass administration and collection of data in a single sitting. Examples involving actual situations in these respective categories may serve to illustrate these points. During 1999-2000, the UNT PT3 Capacity Building grant team began the year using online data collection techniques but ended the year with a front/back one-page paper form. This was because there was great difficulty in getting all 321 teacher preparation students into a lab with computer access for the first half of the year, and there was a need to quickly gather data from all who completed the survey in one mass administration at the end of the school year (Knezek, Christensen, Zoeller, & Griffin, 2001). By contrast, for the Key Instructional Design Strategies (KIDS) project evaluation (Knezek & Christensen, 2000), approximately 75% of the 9,029 baseline data surveys gathered during the fall were paper-based and required 6 months to compile, while more than 90% of the 9,712 spring 2000 surveys gathered were completed via the WWW and required less than 1 month to organize for analysis. The magnitude of the problem necessitated finding an alternative to paper surveys in the latter case.

Mark Sense/OCR. Pre-printed forms that utilize machine-readable bubble-coded responses have been common in the educational area for many years. Typically these can be completed and scored very quickly,

but they are also expensive when commercially produced, quite rigid in response format, and require lead time and printing volume that make their use impractical in many research environments. In the case of our PT3 activities for 1999-2000, the volume of surveys was not large enough to make this approach cost-effective, and the process of designing and printing mark-sense forms would have taken too long. In the case of the Technology Innovation Challenge grant, it was anticipated that some of the survey instruments would need to be modified between pretest and posttest administrations, so a large volume printing would have been wasteful. There was the additional issue of some survey instruments being sufficiently long to necessitate more than one mark-sense form per questionnaire. Initial recommendations to use generic (pre-printed) mark-sense forms along with photocopied survey instruments were soon discarded when the issue of dealing with multiple mark-sense forms per survey surfaced. Newer optical character reader (OCR) technology that can actually sense which response was circled by a teacher or student holds promise for improvements in this area. In these kinds of systems, multiple page surveys simply have the staple removed and each page is fed through a photocopier-type feeder mechanism. If the scanner mechanism has a problem deciphering the mark, it stops and requests that the operator make a judgment based on the scanned image.

HTML forms/E-mailed responses. This elegant approach was developed for experimentation during the fall of 1999 and discarded before being placed into full operation. The concept was simply to have each workstation's local browser post the survey, gather the responses, and E-mail the completed form to a centralized E-mail address when the respondent pressed the 'submit' button at the end of the form. These E-mailed messages then went through a response processing procedure that placed the item ratings in a text file or database. Unfortunately this approach had to be discarded as a universal solution when it was learned that many school-based browsers were not typically configured to send E-mail. Nevertheless, in a modified form the approach continued to be used throughout the fall of 1999. For the KIDS project in particular, a web server was used to post the survey and gather the information, and the server itself launched the E-mail to the central collection site. Post-processing difficulties related to hidden characters, incomplete data caused by randomly-distributed failures by respondents to complete selected items, and space limitations (500-1000 messages) for E-mail inboxes, all contributed to the perception that this system was too cumbersome to be workable with 1999 technology. Still, even with all the difficulties encountered, because the collection system is totally decentralized (survey could even be loaded from and responses written to a local floppy), this system is the most scalable of all the approaches explored. It appears likely that a system capable of surveying all teachers in the USA in one day, or all teachers in the world in one week, would need to based on an approach similar to this.

HTML forms writing to text file(s). This system was developed during the fall of 1999 and continues to be our backup approach as of the fall of 2000. In order to speed development for PT3 pretest administrations, survey instruments were placed online for web access using FrontPage as the development tool and FrontPage server software running in a Windows NT environment as the delivery mechanism. The server presents the form to the respondent and gathers the data when the respondent clicks the "send" button after completing the survey. The server writes the data into a tab delimited text file for further processing via SPSS or a database program. Practical limitations we have encountered have to do with the server becoming swamped and unable to process in real time all responses whenever more than 20-25 users are pressing 'submit' nearly simultaneously. This limitation has forced us to move to the database system described below. Future plans call for not abandoning the text-file-writing approach but instead using CGI scripts on a Unix-based platform in order to ameliorate some of the practical shortcomings of the current system.

HTML or Database-published forms writing to database via the Internet. This approach is centralized and elegant. Theoretically it should work well. However, we have found that when administering long (> 100 item) surveys using FrontPage, we still sometimes encounter 'multiple hit' bottlenecks. This is true even when running on a Pentium 500 Windows NT server with a large amount of RAM and a multiple gigabyte reserve of unused hard drive space -- even when using Access as the database. As a result, we sometimes have difficulty simultaneously administering surveys in two student labs of 32 machines each, and we have found ourselves needing to develop a schedule to spread 12 schools from a large suburban school district in Texas over a six week data collection time period.

Competing database approaches

Several competing database approaches appear to be vying for universal adoption in the not-too-distant future. Microsoft Access interfaces well with FrontPage, and is widely used. FileMaker Pro works well with web server software, is easy to use, and has been successfully used in producing graphical feedback (color bars) for a teacher who has completed his/her form. Commercial packages akin to voter polling systems or product advertising/feedback systems have made inroads into the realm of educational survey administration as well. However, many of these are based on hardware/software platforms costing an order of magnitude more than the solutions envisioned by the authors as affordable for an individual researcher or school district.

Compatibility with data analysis systems

One problem that arises with most database solutions to the problem of online survey administration is how to get the data out of the database and into a tab-delimited or comma-delimited text file for use in a statistical data analysis package such as SPSS or SAS. Typically a researcher will not be sufficiently familiar with Access (a relational database package) or FileMaker (a flat file manager) to be able to merge files and write the proper output in a single record as text. Reliance on a database appears to create the need for manager at the server site who can transform these files on short notice.

Prospects for the future

Our long-range plan is to consolidate the data acquisition approaches currently in trial operation into just one or two types, regardless of whether the service will be used by PT3 respondents, by others, or in combination. We are not optimistic that in the short run all of our needs can be met through a single platform, so we plan to maintain development toward a fully interactive system that gives immediate graphical feedback to the respondent, and also toward a large-scale, highly efficient system for simply gathering and perhaps screening the data. In both of these approaches we plan to begin more clearly separating the (forms serving) data presentation and acquisition process from database management and analysis.

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P3T3: Purdue Program for Preparing Tomorrow's Teachers to Use Technology

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Abstract: This paper describes P3T3: Purdue Program for Preparing Tomorrow's Teachers to use Technology, a PT3 project designed to: (1) prepare pre-service teachers to demonstrate fundamental technology competencies, and (2) prepare teacher education faculty to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use themselves. The paper describes the project's three complementary components: (a) a comprehensive faculty development and mentoring program; (b) use of two-way communication technologies, notably IP-based video conferencing, for distant field experiences designed to expose students to diversity and technology use; and (c) development of a dynamic web-based digital portfolio system for pre-service teachers.

Introduction

Deficiencies in the preparation of teachers to use technology in the classroom have been highlighted in a number of national reports (e.g., Moursand & Bielfeldt, 1999; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997). These reports indicate that technology is not central to teacher preparation in most colleges of education. Problems include limited use of distance education and computer-assisted instruction in teacher education courses, an emphasis on teaching about technology rather than teaching with technology, lack of faculty modeling of teaching with technology, insufficient funding and faculty professional development opportunities, and lack of emphasis on technology in students' field experiences.

Given that an estimated 2.2 million teachers are expected to join the work force in the next decade, the time for teacher education to change is now. The recent study by the International Society for Technology in Education (ISTE) commissioned by the Milken Exchange (Moursand & Bielfeldt, 1999) recommended: (1) institutional planning for integration of educational technology into teaching and learning, (2) technology integration across the teacher preparation curriculum rather than limited to stand-alone courses, (3) increased opportunities for student teachers to use technology during field experiences, and (4) faculty development to bring about appropriate modeling of technology uses in their courses.

After five years of reform planning by its faculty and administration, the School of Education at Purdue University has begun the implementation of completely restructured elementary and secondary teacher education programs that make significant strides toward addressing the recommendations of the ISTE/Milken report. The new programs, which were launched with students entering teacher preparation programs in the fall of 1999 and will not be fully implemented until the spring of 2002, feature a cohesive set of block courses

and practical experiences that are anchored by four strands – technology, diversity, field experience, and portfolio assessment.

In Purdue's new teacher preparation programs, the technology strand is manifest in: (1) concentrated course work focused specifically on educational technology (e.g., EDCI 270, Introduction to Educational Technology – an introductory course that focuses on helping students build basic technology knowledge and skills within the context of planning, implementing, and evaluating instruction); (2) integrated instruction in the application of technology in specific disciplines and with a variety of learners throughout block courses and in methods courses; and (3) reliance on supporting technologies for communication and to provide examples of exemplary practice. The diversity strand is supported through appropriate course work and by exposing pre-service teachers to various forms of diversity (e.g., socioeconomic, rural/urban, religious, cultural, intellectual, special needs/gifted populations) during field experiences in neighboring schools. However, Purdue is not located near a major urban center and hence cannot easily expose students to certain types of cultural and ethnic diversity. The field experiences strand is supported by a Theory Into Practice (TIP) component that accompanies each block of courses in the new program. The TIPs provide more and more cohesive field experiences for our students than were available in the past. Finally, in the new program, each student will develop a professional portfolio that will: (1) be used for self-reflection on learning, (2) document professional growth, and (3) provide the foundation for performance-based licensure. Helping to guide implementation of the new programs and ensure that technology is integrated as originally intended, Purdue is engaged in a PT3 implementation grant, entitled P3T3: Purdue Program for Preparing Tomorrow's Teachers to use Technology.

The overall goals of the P3T3 project are to (1) prepare pre-service teachers to demonstrate fundamental technology competencies, using technology as a tool for teaching/learning, personal productivity, communication, and reflection on their teaching, and (2) prepare teacher education faculty in Education as well as colleagues in Science and Liberal Arts, to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use themselves. The project will meet its goals via three complementary components: (a) pre-service teachers will be taught by technology-proficient faculty who participate in a comprehensive faculty development program in which they learn new teaching/learning technologies and practice using them with mentoring and technical support leading to lasting technology integration into teacher education courses; (b) pre-service teachers will participate in rich and diverse field experiences enabled and enhanced through the use of technology; and (c) a dynamic assessment system will provide pre-service teachers the tools and opportunities to select multiple ways of viewing their evolving teaching practice, reflect on that practice, and use digital representations to meet performance-based assessments as they build digital multimedia portfolios. Ultimately, the pre-service teachers will learn about technology, integrate it as they see it modeled by their instructors, and reflect on their own learning about teaching via digital technologies that they will eventually model and use with their K-12 students.

This paper provides an overview of three implementation components of the P3T3 project: faculty development, technology-enabled field experiences, and a dynamic digital portfolio system. Together, these three components provide a cohesive solution to many of the problems related to technology integration that confront colleges of education, and one that fits well the particular needs of teacher education at Purdue University.

Faculty Development

The faculty development component of the project focuses on helping faculty to develop technology knowledge and skills by modeling learner-centered approaches that they can use with their pre-service teacher (who, in turn, can use them with their K-12 students). In technology-rich classroom environments, teachers tend to shift toward more learner-centered practices (Sandholtz & Ringstaff, 1996). Adopting a problem-based perspective to teaching technology (Hill, 1999) offers an approach that aligns with the learner-centered characteristics of the technology-rich classroom. P3T3 faculty development approaches include problem-based workshop experiences, use of mentoring teams with technical support, and online support.

As originally conceived, the professional development component of the project for a group of faculty was intended to begin with a week-long introductory workshop followed by year-long participation in

mentoring teams. Faculty development workshops were planned for the summers when most faculty members have times of availability. Each workshop was to enroll about 20 participants consisting of about 10 Education faculty members, 4 graduate teaching assistants who work with teacher preparation courses, 2 faculty members from Liberal Arts and/or Science, 2 Education undergraduates, and 2 master technology-using teachers from our K-12 partner schools. In this, the first year of the project, we were forced to make a change because a late start left us unable to organize workshops for the summer of 2000. Instead, we scheduled the first faculty workshop as an abbreviated two-day start-up workshop during the fall semester break and then followed this with a variety of mini-workshops for faculty at times scattered through the fall semester. Our first workshop also was not as representative of all of the constituencies as we wanted, because no non-Education faculty or undergraduate students participated. However, a mixed group of participants remains a goal for each of the workshops to come.

Our initial two-day mini-workshop was designed to model problem-based learning processes as described by Torp and Sage (1998). In this process, individuals are confronted with a complex problem, define the parameters of the problem, conduct an investigation, and communicate the results. For our workshop, we had groups of faculty members address the question, "What technologies are available at Purdue University to support teaching and learning, how can they be used, and what do faculty and students need to know about them?" Teams of participants developed their own investigations, gathered information, and prepared a multimedia report about their investigation for the other groups. Technology was used during this process to acquire background information (e.g., Internet), produce artifacts (e.g., digital camera pictures), and prepare a presentation (e.g., Powerpoint). Through this process, faculty members were exposed to constructivist approaches to technology integration in the service of content learning. They were able to observe the processes, reflect on the roles of teachers and learners, and see certain applications of technology in the classroom.Following the problem-based learning activity, a variety of available technologies were demonstrated simply to raise awareness of them. Faculty cannot be expected to integrate technologies unless they have some conception of what they can do and how they might be used. Then, we asked faculty to develop their own concrete plans for integrating technology into one of the courses that they teach. The project provides support, in the form of expert assistance and funding, to help implement these projects during the coming year.

As a final step, we offered a number of "how-to" workshops throughout the semester for participating faculty and others. Topics included: web page design, use of the WebCT environment, graphics, managing one's university computer account, and so forth. To achieve extended support, an academic year-long mentoring program (abbreviated to one semester in the project's first year) is underway. Experienced faculty members who integrate technology in their teaching, along with the project's graduate assistants, work with a team of less-experienced faculty members who completed the workshop. Each team member pursues his/her personal and course technology integration goals established at the end of the workshop. Teams meet regularly to discuss implementation activities and to provide mutual support. In addition, work is underway to establish a web-based electronic community where faculty can exchange ideas and gather resources. Faculty who successfully complete a year of professional development activities, and who effectively integrate technology use into a course, will be eligible to lead professional development activities in subsequent years.

Technology-Enabled Field Experiences

Many colleges of education face difficulties placing students in field situations that provide for needed experiences such as interaction with diverse student populations and implementation of exemplary technology use. This problem is particularly acute for Purdue, which is not located near a major metropolitan center. As one way to address this problem, Purdue's P3T3 initiative is making use of two-way video conferencing to link college students and classrooms with K-12 students and classrooms.

Several video-based conferencing technologies are available for use depending on the nature of the activity and the types of interactions desired. For person-to-person interaction, desktop videoconferencing over the Internet provides a convenient and low-cost option. Each party must have a computer equipped with a microphone, speakers, an inexpensive camera, and appropriate software such as White Pine's CUSeeMe or Microsoft's NetMeeting. The grant provides equipment for equipping partner school classrooms with this

technology. We will be exploring this option for one-to-one interaction, such as tutoring, between a Purdue pre-service teacher and a child in a K-12 classroom but as of this writing we have not implemented any activities using it.

For group interaction, a higher quality video conferencing solution is needed. High quality videoconferencing can be obtained by systems that operate over high-speed telephone lines (e.g., fiber, ISDN) or over the Internet. In Indiana, over 200 schools are part of a fiber optic video network called Vision Athena that is operated by the Corporation for Educational Communications, a partner in the P3T3 project. Although Purdue is not part of the Vision Athena network, we can link our ISDN-based PictureTel videoconferencing unit to the Vision Athena network via a network bridge. While the quality is not as high as the purely fiber network, this system has already been used on multiple occasions to link Purdue classes with classes at K-12 school sites, and it will continue to be used in the P3T3 project. A new option is the use of IP-based videoconferencing systems, such as those made by Polycom (http://www.polycom.com) and other vendors, which support the H.323 standard for video conferencing over the Internet. These units can operate at data rates from 128K to 768K and yield results comparable to ISDN-based compressed video systems such as the PictureTel unit that Purdue already uses. Initial experiments in the use of this technology, which is markedly superior to computer-to-computer desktop video conferencing, suggest that it provides a viable alternative for some types of student observations and interactions in school-based settings that typically occur through traditional field placements. As long as adequate bandwidth is available between the school and university site, this technology can support class-to-class videoconferencing.

In the first P3T3 project experiment in implementing two-way connections with a K-12 site, Professor JoAnn Phillion used a Polycom Viewstation to connect her class to an elementary school classroom in East Chicago, an urban area in the northern part of Indiana. The students in Professor Phillion's class, who were enrolled in the first block course in the teacher education program, were able to make observations of the class, interact with students and the teacher, and even teach some small instructional units via the two-way video connection themselves. The connection at 256K was solid with only occasional dropped packets resulting in a high-quality two-way video linkage. This experience suggests that these two-way video connections can expand opportunities for our students to engage in "field" experiences reaching the kinds of diverse sites, such as urban settings, that would ordinarily be very difficult because of Purdue's geographic location.

Dynamic Digital Portfolio System

Portfolio assessment is becoming an important way to address competency-based standards for teacher preparation programs. There is growing interest in the use of electronic multimedia portfolios for documenting growth and development of pre-service teachers (Barrett, 2000; Read & Cafolla, 1999). As part of its P3T3 project, Purdue is developing a dynamic web-based assessment system that will provide pre-service teachers with the tools and opportunities to select multiple ways of viewing their evolving teaching practice, reflect on that practice, and use various representations to meet performance-based assessments as they build digital multimedia portfolios.

Digital, or e-portfolios, take many forms from simple repositories of disconnected student artifacts stored digitally on CD-ROMs or web servers to highly organized and systematically retrievable work representing the synthesis of professional growth (Campbell, 1997). In our project we have focused on the latter. We are attempting to build an e portfolio component as one part of what we call a dynamic assessment system. The system is dynamic because unlike traditional text-based portfolio systems, it emphasizes interaction and ongoing reflection rather than archiving of artifacts; and, unlike many existing digital portfolio systems, it emphasizes the complexity of teaching practice through a variety of web-based components that provide resources about how ongoing teaching practice and assessment are tied to existing theoretical frames, and provides a "community of learners" component where pre-service teachers can interact with peers about their mutual experiences in their evolving practice.

The dynamic assessment system uses the e-portfolios as one component of a Unit Assessment System (UAS), the plan in the School of Education that indicates how pre-service teachers are meeting new performance-based state licensure guidelines. The e-portfolio is comprised of two primary components: (a) a

web-based input template in which all pre-service teachers can enter digital artifacts (pictures, video clips, audio clips, text files) they can categorize according to three broad Principles in Practice that organize how they are thinking about learners, curriculum in context, and ongoing professional growth and participation in the teaching profession, and (b) a query component in which they can systematically acquire a "presentation" version of the portfolio in which all artifacts classified according to performance assessments, theoretical frames, instructional principles, and ongoing reflective themes, can be retrieved for formative assessment purposes (pre-service teachers' ongoing assessment and reflection on evolving practice) and summative purposes (presentations to portfolio evaluators at key checkpoints on the teacher education program). On the input side, we anticipate that several links will be available: (a) Communities of Learners in Practice, (b) Theory in Practice, (c) Performance in Practice, and (d) A Continuum of Growth. The Communities of Learners in Practice page will include our P3T3 partner schools and their web sites, along with our own P3T3 site and the national PT3 site and a page explaining the various projects at Purdue that are related to these initiatives. Theory into Practice will include resources about theoretical foundations of teaching, learning, and reflection on teaching. Performance in Practice will link to a variety of resources providing examples and models of various teaching practices that students can compare with their own evolving practice. Finally, A Continuum of Growth will provide links to a Purdue University's Professional Development Schools and the school web sites, other courses or collaborative initiatives of the School of Education that a student or visitor might be interested in, and links to various professional organizations

Both faculty and students will have the ability to log in and have tools and features accessible to them when they enter the e-portfolio area from the main page. For example, a student who logs in might go to the site of a P3T3 partner school and locate a video of a teacher using a project-based activity with science students. The teacher education student may watch the video, see the teacher's lesson design and comments about the lesson, and then activate a "reflective writing" tool to comment on what he or she sees. The observations made in the reflection box/pad (dialogue window) will then be automatically recorded in the student's portfolio in a designated place. When artifacts are retrieved via a query, the retrieval will occur in such a way that all artifacts, their interrelations to one another, and the student's ongoing reflections of evolving practice are all displayed along with a map that shows how a given student is meeting performance goals of the UAS as he or she moves through the teacher education program. Ultimately the e-portfolio system will meet the primary goal of the P3T3 project by providing a forum in which pre-service teachers, though their use of technologies needed to build and use the portfolio, learn about and feel competent with the very technologies we want them to use with their future students.

Conclusions

Purdue University's PT3 initiative, P3T3: Purdue Program for Preparing Tomorrow's Teachers to use Technology, seeks to prepare our teacher education students to effectively utilize computers and allied technologies for personal productivity, for documenting and reflecting on teaching practice, and for effective teaching and learning. Three interrelated components form the basis of our approach for achieving these aims: (1) a faculty development program, (2) use of two-way communication technologies for virtual field experiences, and (3) development of a dynamic web-based digital portfolio system for pre-service teachers. The faculty development program focuses on the use of problem-centered approaches to technology use with a year-long mentoring and support program to help faculty integrate educational technologies their own courses so that they effectively model its use. Two-way video communication technologies, notably IP-based videoconferencing, allow students to observe and interact with school sites from a distance. This permits students to experience diverse school sites unavailable in the vicinity of the university and so broaden their horizons and preparation. Finally, the development by all pre-service teachers of digital portfolios is a component of a dynamic assessment system for the School of Education. Through the development of web-based portfolios, students will reflect on their emerging practice, demonstrate competencies needed for licensure, and, at the same time, learn about and use the very technologies that we want them to use with their students. Through these approaches, we seek to ensure that teacher education reforms at Purdue, initiated less than two years ago, are implemented according to a vision that emphasizes diversity, field experience, portfolio assessment, and technology as key to the preparation of all teachers. For more information about the

project, visit the project website at: http://research.soe.purdue.edu/p3t3.

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Preparing Tomorrows Teachers to Use Technology Implementation Grant For The Years 2000 – 2003: Raising The Technology Learning Curve by Energizing Teaching to Empower Students through Emerging Technologies

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Abstract: This paper presents program goals implemented through a Preparing Tomorrow's Teacher's to Use Technology PT3 implementation grant at Clarke College. One goal is to design a "school" environment in real and virtual spaces to transform learning throughout the liberal arts and education departments. These new "school environments" provide space where new knowledge is created together as a community of learners. A second goal is to build a web-based virtual space to facilitate communication between and among our learning communities: K-12 students and teachers, teacher preparation students, and liberal arts and education faculty. This virtual learning space provides tools for "digital" exchanges using email, the Internet, and the Iowa Communication Network (ICN). A third goal is to create an Alternative Licensure Teacher Preparation Program. This graduate licensure program offers technology learning opportunities to prepare re-entry teachers, mid-career changers, and out of field teachers for the 21st century workplace.

Part I. PT3 Program Goals

This paper presents program goals of our Preparing Tomorrow's Teacher's PT3 implementation grant. Clarke College, together with its partners, the Catholic Schools of the Archdiocese of Dubuque and the Iowa College Foundation, has created a program to improve instruction of our pre-service teachers through effective use of information technologies. Components of this program incorporate new teaching paradigms implemented through program goals and a technology-learning plan.

One component of our program is the creation of "school" environments in real and virtual spaces to transform learning and teaching. These new "school environments" are where students and teachers explore, discover, and create new knowledge together as a community of learners. This component includes a program for designing strategies for infusing information technologies throughout liberal arts and education coursework. Faculty development programs provide instructional training on techniques for creating "smart technology" environments.

A second component is the building of a web-based virtual space to facilitate communication between and among our learning communities: K-12 students and teachers participating in Clarke's education program, pre-service teachers, liberal arts and education faculty. This virtual learning space provides tools for "digital" exchange of information and resources through email, the Internet, and the Iowa Communication Network (ICN).

A third component is the establishment of an Alternative Licensure Teacher Preparation Program. This graduate licensure program provides learning opportunities to prepare re-entry teachers, mid-career changers, and out- of- field teachers for the 21st century workplace.

Grant goals form the framework for implementation of program objectives, activities, training, and support transforming learning environments throughout liberal arts core courses and teacher preparation program. They are as follows:

Goal 1: To create innovative improvements in our existing liberal arts and teacher preparation program by enhancing coursework and student activities through transparent use of technology resources.

Goal 2: To create a learning exchange to facilitate digital connections between and among Clarke College faculty and K-12 teachers and students in our Archdiocesan Catholic Partner Schools.

Goal 3. To create a new graduate Alternative Licensure Teacher preparation program for preparation of re-entry teachers, mid-career adults and out-of field teachers.

Continuous achievement of performance objectives sustain a climate for college faculty, students, K-12 teachers and students to facilitate building collaborative models for exploring "learning how to learn" together through transparent use of information technologies.

Ongoing project activities exemplifying innovative improvements are:

1) offering one-to-many and one-to-one learning opportunities to faculty,
2) developing techniques for strategizing support to liberal arts and education faculties for integrating new models of instruction into coursework,
3) providing student training in technology skills through the Student Technology Assistants Plus+ (STA+) Program to extend technical support to faculty,
4) creating an online structure for collaboration and community building where students and teachers connect, communicate, and share resources through a web-based digital exchange,
5) developing a telementoring program as a vehicle to sustain support for first-year teachers during their critical first year of teaching, and
6) creating an Alternative Licensure Teacher Preparation Program to meet the critical shortage of K-12 teachers in Iowa as well as to prepare new teachers with technology rich models for teaching and learning.

A Technology Education Center (TEC) provides space for one-to-one and many-to-one training sessions for faculty. This center is equipped with hardware and software to provide opportunities for learning new technologies, such as, high-end computers for creating multimedia projects, scanners, digital video cameras, and content specific software appropriate to education and liberal arts courses.

Additional learning opportunities for faculty are provided through an "Anytime, Anyplace Technology Learning Space" (AATLS) consisting of a wireless mobile unit containing 15 laptop computers for teacher training sessions. This AATLS provides a flexible, hands-on learning/training space using portable laptops and a multimedia projector. A technology resource specialist utilizes these spaces offering designing and planning opportunities for faculty. STA+ students are trained to assist the technology resource specialist in extending support across the liberal arts and education departments.

Our project creates innovative models to improve the current teacher preparation program. The National Educational Technology Standards (NETS) aligned with the Interstate New Teacher Assessment and Support Consortium (INTASC) standards provide a framework for assessment of pre-service technology skills. These standards are incorporated into education department course syllabi to promote a seamless integration of technology into all education courses.

The following vignette is one example of a learning model for our teacher preparation students exemplifying a best learning practice using technology. Three secondary education/biology majors completed research on types of authentic prairie plants and animals native to Iowa prairies. Students used electronic data base programs as well as PowerPoint and digital imaging processes to produce their electronic product. They presented their research results to Clarke College Administrators and requested a piece of land on the Clarke

campus to plant a prairie. This prairie will become a permanent authentic learning environment for Clarke students and K-12 students in Dubuque.

Learning with technology extends from the Clarke Campus to our two Archdiocesan Professional Development Schools where pre-service teachers are placed for field, student teaching, and clinical experiences. The Professional Development School was created in collaboration with St. Mary's/St. Patrick's and St. Anthony's Catholic Schools in the Archdiocese of Dubuque At the professional development site Clarke students attend college classes and collaborate with faculty and K-12 teachers "on-K-12-site" to practice a seamless integration of technology within the learning environment.

Pre-service elementary teachers bring laptop computers into the K-8 environment to implement strategies for incorporating technology into the curriculum. Students use programs, such as, Inspiration, HyperStudio, Microsoft Office Suite, and the Internet to produce new learnings through effective uses of technology.

New "digital" web based communication exchanges facilitate and maintain communication between and among members of our learning communities: Clarke faculty, K-12 teachers and students, pre-service and first year teachers, and teacher mentors. Examples of digital tools utilized are: email, the Internet, and the Iowa's Communication Network (ICN). New web applications support communication between and among our learning communities through the creation of discussion forums and chat rooms. This virtual space showcases technology rich learning processes and products created by Clarke education students, education and liberal arts faculty and K-12 teachers. Projects can be accessed at the following url: http://www.clarke.edu/pt3.

Another project is the creation of a new graduate Alternative Licensure Teacher Preparation Program. The goal is to recruit and prepare new teachers through a program enriched by technology instructional models. This program offers re-entry teachers, mid-career adults, and out of field teachers a technology rich program to prepare them for the 21st century workplace. The Iowa Communication Network (ICN) is one technology utilized for course delivery. This system provides a two-way audio/video course delivery utilizing ICN classrooms across the state of Iowa. This program description is explained in part II of this paper.

Part II. Alternative Licensure Program

Justification for Program

It is projected that 40% of Iowa's teaching force will retire within the coming decade. Our current teacher education programs are not graduating sufficient teacher candidates to make up this loss (Heldt, 2000). During the summer of 2000 the Iowa State Department of Education proposed rules for an alternative preparation license and urged colleges within the state to design programs that would meet these requirements and also attract a broader audience.

The development of alternative routes to teacher certification is a trend that has grown steadily since the 1980's in this country, particularly in states that faced fast-growing populations and teacher shortages earlier than Iowa. In 1999, forty states reported having alternatives to approved college teacher education programs for certifying teachers (Feistritzer & Chester, 2000).

Determination of Target Population

National statistics indicate that prospective teacher candidates are to be found among people who already have degrees in fields other than education, people older than the traditional 18-22 year old college student cohort, people who are changing careers, former military personnel, and among ethnic and racial groups that are currently underrepresented in our teaching force (Feistritzer & Chester, 2000). Of 63 non-traditional aged (over 24 years) daytime students at Clarke College (5% of the student body), 27 (22.5% of the non-traditional group) are currently enrolled in our teacher preparation programs, but a number of them have expressed the difficulties they face trying to maintain their other job and family responsibilities and also attend classes given in our usual daytime format. (Clarke does have 227 non-traditional students participating in evening classes in fields other than education.) We anticipate more adult students being interested in teacher preparation if the scheduling and course delivery methods meet their needs.

Investigation of Viable Models

Roth as quoted by Turley and Nakai (2000), noted that alternative routes to certification typically seek to fast track or circumvent traditional university-based teacher education. Some see alternative routes as a serious threat to university sponsored professional preparation. Still others maintain that the issue is not over professional preparation per se but over the timing and institutional context for teacher preparation. Programs are operated by the local school district, by state departments of education, and by colleges and universities. It is our contention that it is possible to develop programs that provide high quality professional preparation and provide that training through means and with schedules that are accessible to adults with family and job responsibilities.

As a college, we determined that the model that appeared most likely to gain approval by our institution and by the State Department of Education of Iowa would be grounded in the competencies that a beginning teacher needs in order to teach and manage a classroom environment effectively and that would meet the requirements of the state's proposed rules for alternative preparation. The core of knowledge provided to our current pre-service teachers had to be made available through delivery systems and on a schedule that would serve the new populations we were targeting.

Inclusion of Stakeholders

At this point, contact was made with stakeholders in this endeavor. Conversations were held with directors of personnel in the local public school district; the superintendent of the Archdiocese, a parochial school district of ten K-8 schools and one high school; the teacher representative of the local teacher's union, and a list of key personnel in schools within a nearby three-state region. An informational meeting was held with administrative and student services departments on our campus whose buy-in and support is crucial to the success of such a program. These stakeholders included the academic vice president, the vice president for adult and continuing education, the vice president for college advancement, the vice president for business and finance, the public relations department, the grant-writing department, and the library. The needs of this program for distance, online, and evening services such as admissions, registration, fee-paying, financial aid, academic and career advising, library and bookstore services were addressed. The stakeholders expressed support and appreciation for being brought into the program early in its development.

Design of Proposed Program

A first decision was to target adults who already have a bachelor's degree. Therefore, rather than develop another undergraduate program, ours would build on their prior education and provide both a master's degree and the competencies necessary for teacher licensure in Iowa. The education core courses were re-envisioned at a master's level.

Both elementary and secondary education candidates would take the six three-credit-hour courses that form the education core. The titles of these courses and the key topics for each reflect the mission of the college to develop personally and socially responsible individuals. They include: Introduction to Reflective Teaching, Active Learning: Constructing Knowledge, Teaching in a World of Diverse Learners, Balanced Assessment and Issues in Evaluation, Managing the Classroom Environment for Effective Instruction, and Teaching for Social Justice in a Multicultural World.

After completing the education core, the elementary and secondary tracks would diverge. Elementary majors would take two intensive three-credit hour curriculum and instructional methods courses. Secondary majors would take a general middle school/secondary school methods course followed by a discipline-specific methods course dealing with music, art, physical education, laboratory science, foreign language, English or history methods related to the student's content area.

The optimum timeline for students in this program would be eighteen months, completing the core and methods courses in fall, spring and summer semesters. One semester would remain in which the candidate would do a sixteen-week, all day internship or student teaching requirements for which twelve credit hours would be granted.

The delivery method(s) envisioned for the first twenty-four credit hours include heavy use of WebCT courses with strongly interactive elements including scheduled chat rooms and listserv, email, or forum exchanges of ideas, reflections and beliefs regarding course readings and online lectures. To simulate some of the classroom observation and participation that the best practices teacher preparation programs provide a collection of video clips of exemplary teaching practice in action will be utilized. Students will develop lesson

plans to provide instruction similar to the best practices videos. In addition to web and video, a third technology, two-way audio-video classes will be used to allow students to participate in and view peer teaching in which students teach their classmates. Two-way audio-video class meetings using the Iowa Communication Network (ICN) may be used to introduce courses and to build community among the cohorts of students who will continue through this entire program as a group.

Partnerships with schools in communities where our students reside will aid us in providing opportunities for a minimum of forty hours of live classroom experience prior to the internship. Forty hours is the current Iowa state requirement. This program will of necessity have to be flexible in finding alternative ways to meet the requirements and develop the needed teaching skills.

Funding and permission to provide internships with a stipend to cover cost of living for the sixteen-week final semester are being sought. A strong mentorship with a teacher in the school where the internship takes place is a requirement. Clarke faculty or Clarke-hired adjunct faculty will serve the same role they currently fill in student teaching, including weekly observations of the student teacher or intern.

This proposal is being evaluated by the Clarke Education Department, the Clarke Educational Policy Committee, and will then be taken to the Iowa State Department of Education for program accreditation.

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Developing a Foundation for Enhancing Modeling of Technology Integration

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Abstract: Recent national survey shows that most college and university faculty do not model the use of information technology skills while most student teachers do not routinely use technology during field experiences. This paper discusses a consultant-client model related to the current issues in teacher preparation, and reports the development and progress of the federally-funded "Teaching to Learn" project at Oakland University involving urban and suburban school district partners. We believe that a strong, positive and collaborative relationship between the pre-service student and the in-service educator (university or K-12) is a potent force for change and success in technology integration. A project course is presented, with discussions on the model's goals, needs, challenges, and opportunities.

Project Purpose, Context and Model

Technology has the power to improve teaching and learning. However, making informed decisions about effective use of technology requires more than just an understanding of hardware and software. It requires the knowledge and wisdom of an experienced teacher who understands issues related to curriculum, and learning processes and outcomes. A teacher preparation program needs to take the perspectives into consideration. According to a survey commissioned by the Milken Exchange on Education Technology on how schools, colleges, and departments of education in the United States were preparing new teachers to use information technology in their work (Moursund, 1999), the following concerns were identified:

1. Most faculty do not model the use of information technology skills.
2. Most student teachers do not routinely use technology during field experience and do not work under master teachers and supervisors who can advise them on information technology use.
3. The "integration factor", composed of items that addressed graduates' class-room skills and the actual use of information technology during college training was the best predictor of other scores on the survey.

The School of Education and Human Services (SEHS) at Oakland University identified these concerns a number of years ago and set out to remedy the problem. Oakland University has a long history of preparing our teacher education students to use technology in the classroom. For almost 20 years, Oakland has offered a Microcomputer Applications in Education Certificate at the graduate level and for over 10 years has required our pre-service elementary teacher education students to take a technology applications course. Graduate students in both the Master's and Doctoral programs in Reading and Language Arts can minor in Instructional Systems Technology (IST) Programs that include courses in exploring the use of advanced technology in the classroom in light of current brain research, multiple intelligences, and information processing and Constructivist perspectives (Caine & Caine, 1991; Gardner, 1983, 1985; Stepich & Newby, 1988; Duffy, Lowyck, & Jonassen, 1993). Those courses have laid emphases on multimedia authoring, exploring educational software, using basic computer tools for classroom management and learning activities, exploring electronic stories, using software to enhance higher level thinking skills, teachers telecommunicating, advanced Hyperstudio, authoring for the WWW, digital video editing, teachers and students using the WWW, etc.

Our most recent efforts involve a U.S. Department of Education, Preparing Tomorrow's Teachers to Use Technology grant entitled: "Teaching to Learn: A Consultant/Client Model to Enhance Classroom Integration of Technology." This project places digitally literate pre-service teacher education students and established educators in a mutually supportive and collaborative environment which results in a major shift in the information

technology experiences available to these and other students as they learn to construct effective learning environments.

Project Course: IST 464 Consultation: Integrating Technology in the Classroom

The "Teaching to Learn" project is a Student Initiated Model. This model is designed to use the technology skills of our students to assist educators (university or K-12) in bringing computer mediated communication and information management to be modeled in university or K-12 classrooms, and to enhance the technology integration modeling our students experience in their field placements.

Our pre-service students are also beginning to develop a digital portfolio in their required technology course (IST 396: Education Uses of Microcomputers and related technologies) which will serve as documentation that they have achieved competency in the areas identified within the SEHS Technology Plan and the National Educational Technology Standards (NETS), International Society for Technology in Education (ISTE). For purposes of the model proposed here, the digital portfolio will serve as the "certification" of competency that is used as a prerequisite to registering for a course where the student functions as a technology consultant.

Once a pre-service teacher education student has completed the required technology course, that student is eligible to register for a 4 semester hour Technology Consultant class (currently designed as a project course - IST 464: Consultation: Integrating Technology in the Classroom). This class is offered as a regular university class, though the requirements are unique. The instructor of this class is responsible for overseeing and evaluating the experiences of students in their placements. For instance, suppose we have 25 pre-service teacher education students in the Technology Consultant class: some are elementary and some are secondary education students. Each of these students has a number of possible placement options. They can work as a technology consultant with a faculty member at the university, or work with an elementary education teacher in a classroom setting, or work with a secondary education teacher who is teaching in that student's major area. The student can also work as a resource person in our Educational Resource Laboratory (ERL) to help other students who are developing their technology integration skills and their digital portfolios. During Technology Consultant course sessions, students receive instruction on consulting skills and are provided with opportunities to enhance their technology application skills through whole group presentations and small group hands-on collaborative learning experiences.

When assisting an in-service educator (university or K-12), the technology consultant agrees to spend 10 hours per week for 10 weeks helping the client (in-service educator) more effectively model technology integration in the classroom. The consultant may attend and assist in sessions of the faculty member's classes. However, the technology associate is not responsible for the content of the class, but rather for helping the faculty member identify and implement the modeling of technology in support of the faculty member's goals for the class. Students have the opportunity to collaborate with a professional in their field in the design of technology supported learning environments, gain experience in doing technology integration needs assessments, and in making technology integration decisions and experiencing the outcomes of those decisions. Further, all of our student consultants gain increased exposure to a variety of continuously evolving models of technology integration. When assisting a collaborating educator (university or K-12), the students spend approximately the 10 hours per week on consultant related activities in and outside of the client's classroom. All student Technology Consultants communicate electronically to share their experiences and resources with their classmates during the process of their work.

Challenges of Fitting Project Course into Teacher Education Program Requirements

To date we have offered the Technology Consultant course as a pilot course with 8 student consultants and as a fully approved course with 18 students. Without a doubt, the most difficult challenge we have encountered is finding a way to make the course attractive to students who already feel they cannot possibly fit one more thing into their busy schedules. In the beginning, this course was viewed by students as both an extra expense and an extra time commitment which had no legitimate place in students programs. Only the most committed students chose to participate. By the time the grant ends we must demonstrate that this is a "don't miss" opportunity that students will seek out even though it does require extra effort.

While we operate under the grant we can offer extras which will not be available when the funding runs out. We have employed various incentives during this development period. Our Vice President of Academic Affairs demonstrated his support of the project by partially subsidizing the tuition of the students in the pilot course. For the first regular course offering we purchased a classroom set of textbooks which students can use for the duration of the course and return at the end. Through the grant we will also be able to return a portion of the cost of tuition to the students after successful completion of the course. Much more important than these short run incentives, we have been successful in getting the course approved to count as an elective in students' majors and minors. By careful placement of student consultants with either university faculty or K-12 classroom teachers matching their majors or minors, we have been successful in having the Consultant course approved as an elective in the various majors and minors for the participating students.

Support Required to Develop and Maintain this Model

We have pledged that we will continue to support the technology integration efforts of students who have completed the Consultant course by continuing to provide technology workshops and equipment which can be checked out through the duration of the grant. This means that students will have technology support throughout their student teaching and possibly into their first year of teaching. We have intentionally developed the course to the extent that the students who have completed the course are major advocates for the course among their peers.

In addition to the efforts described above, funding from the grant has provided for the development of an on-line "problem-solving" data base which contains step-by-step instructions for using various software applications in classroom activities. This data base is open to all on a university server and can be downloaded by the user at "http://pt3.oakland.edu/consultants/jobform6.asp".

At the same time, our university is providing increased course support to all classes through a web-based course support application which provides on-line chat, discussion forums, calendars, email, etc. Incorporating these other support components has enabled us to modify our required technology course to help all of our teacher education students learn first-hand how the integration of technology can help students become much more independent in terms of developing self-help skills and much more collaborative in making it easier to develop "communities of learners". In the Consultant course, our students have been particularly effective in developing this concept of community of learners through their use of the discussion forum. They have made it very clear that they expect to maintain their community as they move into the next phases of their educational preparation, which for many of them is student teaching. Their discussion forum will continue on a university server.

While we had hoped that our grant activities would provide valuable information we could incorporate into our other courses, we are pleasantly surprised at how quickly our experiences with the grant project development have facilitated change beyond the immediate scope of the project. We have already mentioned the changes occurring in our required technology course. Technology support in our Educational Resource Laboratory (ERL) has been dramatically enhanced through the Teaching to Learn project. Our ERL is a unique facility which combines the roles of an educational resource library and a technology laboratory. By assigning grant funded technology support personnel (students with strong technology skills who are not necessarily education students) to work in the ERL, the ERL has become a magnet for education students who are interested in informal technology support. The director of the ERL, excited by the increased student interest, has become an active technology integration advocate. She had her staff are developing a variety of technology workshops which will continue, independent of grant funding. These workshops can be offered at the request of students, professors, or departments, again, increasing the general level of technology support available and lowering the threshold for integration.

While it is still too early to predict long term results, we are beginning to consider the possibility that perhaps we are close to a critical number of students and faculty who have decided to make an active effort to incorporate technology into their teaching strategies which will function perhaps as a tipping point, making adoption of technology integration much quicker and easier among those remaining. We are certainly seeing an obvious increase in technology related activity. It will be interesting to see if the momentum continues to increase.

Various Project Participants, Challenges and Opportunities

In addition to Oakland University, the "Teaching to Learn" project involves Michigan Virtual University, an urban school district, and a suburban school district as partners. The Michigan Virtual University is to act as a systems integrator or broker between colleges, universities and training providers. Its role in the "Teaching to Learn" project is to provide support in the development of an online set of modules which introduce and provide models for best practices in online learning environment. The participating urban school district has about 25 instructional sites and 13,500 students, with diverse refugee, immigrant and migrant populations. While the District scores are well below the state average on standardized tests that measure students achievement, the school district has demonstrated its commitment to ensuring that its students have the critical experiences and enhanced learning opportunities offered through the classroom integration of technology. The participating suburban school district, on the other hand, has 18 instructional sites with over 13,000 students. Integration of technology into the teaching and learning environment is a top priority and the district has made great strides in the development of technology for its students and staff over the past few years.

Various partners in the "Teaching to Learn" project allow both in-service educators and pre-service teachers to experience technology integration from different perspectives. Overall, the participants expressed positive opinions about the changes in their views and skills of technology integration throughout their participation. They are pleased with the resources provided by the project and agree that their role as a consultant or a client allows them to experience a fundamental mental shift in the understanding of how technology can be used to help improve their classroom teaching practices and enhance the students' learning environment.

The 'Teaching to Learn" project also witnessed challenges and opportunities for the participating consultants (pre-service teacher education students) and clients (in-service educators). One of the major challenges for the consultants is lack of time, since they are usually taking four or even five courses at the same time. The clients also feel difficult to find time to meet with the student consultants, owing to the fact that they are so occupied with their teaching tasks. The lack of hardware and software in some school and classroom settings seem to be another major challenge, especially for the urban participants. Both consultants and clients have to work out ways to deal with the consequent issues. Therefore there are slow progresses in some cases. Some consultants (pre-service teacher education students) may face with potential role conflict because they are functioning as a consultant for the project course and may be placed with the same teacher (client) as a field placement for other classes where this classroom teacher is serving in a supervisory role. Some clients, on the other hand, may encounter negative peer pressure related to their extra efforts to incorporate technology.

With the challenges come the opportunities. The participants become aware that technology is very much their own response to overcome obstacles that stand in the way of a better, more productive way of education, and that technology is their tools, their methods, and their creative attempts to solve problems in the teaching and learning environment.

Michigan COATT Certificate

The "Teaching to Learn" project also aims at a goal of technology achievement for the participants. Early in 1998 Michigan's senior U.S. Senator, Carl Levin, hosted a gathering of over 400 Michigan leaders to focus on the issue of how we were using technology to advance education in Michigan. This meeting resulted in the formation of the "Working Group on Teacher Training in Technology". The "Working Group" completed a plan to create the nation's only standards-based credential to be awarded to teachers (both pre-service and in-service) who demonstrate outstanding achievement in the use of technology to enhance student learning as judged by a multi-institutional review panel. June 3, 1999 was the date of the kick-off news event for the Consortium for Outstanding Achievement in Teaching with Technology (COATT) (visit its website at http://www.coatt.org).

The COATT Certificate is a key factor in the long term institutionalization of the "Teaching to Learn" project. This certificate provides a strong incentive for achievement to students who wish to document that they have achieved technology competence at a level which prepares them to be technology leaders in their schools. Oakland University has participated from the beginning in the development of this certificate. Through workshops, first developed through the "Teaching to Learn" project, then continued through the ERL workshop program,

students who began developing their electronic portfolios in their required technology course will receive the sustained support they need to earn the COATT Certificate, external documentation of their high level of achievement in the area of technology integration in education.

Summary

This paper has presented a consultant-client model in developing a foundation for enhancing modeling of technology integration in university as well as K-12 environments. Oakland university's recent involvement with the "Preparing Tomorrow's Teachers to Use Technology" grant project is reported, starting with a description of project purpose, context and model, followed by a presentation of the project course development and applications progress. Challenges and opportunities related to the current issues of teacher preparation and technology integration have also been discussed. Both consultants (pre-service teacher education students) and clients (in-service educators) participating in the project have experienced positive changes in views and skills in using technology for classroom teaching and learning.

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The Unit of Practice: A Roadmap for Technology Integrated Learning

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Abstract. Teacher integration of technology in K-8 teaching has remained limited despite increasing connectivity and increasing numbers of computers in classrooms. Few teachers use analytic and project-oriented software on a frequent basis. Rrecent teacher education graduates report that they do not feel prepared to integrate technology in their curriculum. To address this low technology integration in teaching, ASU West. through its PT3 grant, is introducing preservice teachers and their mentor teachers to the Unit of Practice (UOP). The UOP, a product of Apple's ACOT project, builds on several learning theories, addresses educational standards, and provides a framework for organizing thought and integrating technology into classroom instruction. It helps classroom teachers guide students' learning through multiple sources of information. The authors discuss the nature of the UOP, how teacher-student teacher pairs develop UOPs that reflect standards, and how the UOPs are assessed in this PT3 project.

Introduction

Using computers as facilitators of students' learning represents a challenge for inservice as well as preservice teachers. Although by 1999, 95 percent of US schools had Internet connectivity (NCES, 1999) and the student-computer ratio was 6:1 (Anderson & Ronnkvist, A., 1999), teacher integration of technology in K-8 classroom teaching has remained limited. Only about one third of teachers assign computer work on a regular basis and elementary teachers still make frequent use of game and drill software (Becker, Ravitz, & Wong, 1999). Few teachers use analytic and project-oriented software on a frequent basis (Becker, Ravitz, & Wong, 1999). The fact that recent teacher education graduates report that they do not feel prepared to integrate technology in their curriculum (U.S. OTA, 1995) exacerbates this situation as they enter the classroom.

As part of a PT3 implementation grant to help teachers integrate technology into their teaching, Arizona State University West provides preservice teachers and their mentor teachers with technology training and an introduction to the use of ACOT's Unit of Practice (UOP). This Practicum Plus Program pairs of preservice and mentor teachers attend a week-long all-day summer workshop followed by monthly sessions during the Fall semester in exchange for 3 graduate credit hours. This paper provides a historical and theoretical framework for the UOP, as well as a description of the UOP and its assessment.

Historical Background

To study how the regular use of computers in the classroom by teachers and students might change teaching and learning, in 1985 Apple Computers began a research and development collaboration with public schools, universities, and research agencies in conjunction with university researchers. ACOT research looked at how computers should be used by teachers to improve students' learning. The project provided computers and training for teachers in selected classrooms known as the Apple Classrooms of Tomorrow (ACOT).

This project was timely and much needed for studying classrooms where students and teachers had immediate access to a wide range of technologies. The rich data from the thirteen years of ACOT demonstrated that the introduction of technology into classrooms significantly increased the potential for learning, especially when it is used to support collaboration, information access, and the expression of students' thoughts and ideas (Fisher, Dwyer & Yocam, 1996).

As part of the ACOT project, Apple Computers, the National Science Foundation and the New American Schools Development Corporation collaborated to create a structured curriculum framework and named it Units of Practice. The UOP is a thematic approach to planning for integrated learning with technology that meets educational standards. This integrated approach allows children to explore knowledge in several subjects (Humphreys, Post and Ellis, 1981) through meaningful association of curriculum areas in a holistic way that reflects the real, interactive world (Shoemaker, 1989).

Underlying Learning Theories

The UOP builds on several learning theories. Brain compatible learning perceives the brain as a social brain that has an innate need for meaning. It also proposes that complex learning be enhanced by challenge (Caine & Caine, 1997). The UOP encourages student collaboration, inquiry and problem solving. Constructivism emphasizes learning rather than teaching, encourages learner autonomy and initiative, encourages learner inquiry, nurtures curiosity, emphasizes performance and understanding, encourages learners to engage in dialogue with other learners, and provides opportunities for constructing new knowledge and understanding through authentic experiences (University of Pretoria, 1996). The UOP exhibits each of these constructivist characteristics. In addition, the UOP reflects Dewey's emphasis on projects and concrete activities, Vygotsky's social interaction, and Bruner's social construction of ideas or concepts based on current knowledge and integrating experiences.

Essential Elements of UOP

The UOP, is a framework for organizing thought and embedding technology into teachers' classroom instruction that draws on principles validated through research. These principles inform teachers in how to design classroom activities relevant to students to foster their learning through doing. The UOP brings into focus seven elements of instruction used to align curriculum with developmentally appropriate standards across grade levels and content. The seven elements (Invitation, Situations, Tasks, Interactions, Standards, Assessment and Tools) are part of the three phases of teaching: planning, instruction and evaluation. The UOP provides teachers with a common language as they integrate technology. It centers on the student as learner with the teacher as a facilitator of learning through modeling, reflecting, and supporting self-inquiry.

The first element of the UOP, the Invitation, focuses on what the students are going to learn and do. It is the curriculum question that teachers and learners will be addressing throughout the entire unit. It is designed to be a thought-provoking question that invites inquiry during teaching and learning process. It is intended to spark students' interest in the unit and provide then with a project overview. It is the teacher's invitation to the students to join in the process of learning, exploring, finding information, raising further questions and finding an answer to this initial unit question.

The second element, Situation, is a clear description of where, when and for how long students will engage in the unit. It not only frames the chronology, but also identifies where learning activities will occur. It specifies the time required for the unit, i.e., a day, week, month or semester. It also addresses the arrangement of the physical environment where instruction will take place.

The third element is Tasks. This is a clear-cut description of what students will do to achieve the goals and standards incorporated in the unit. It explains the activities that are linked to the selected

standards. The tasks must clearly correlate to each standard included in the unit of practice. Each task includes situational or interactional activities.

The fourth element, Interactions, describes group dynamics and the roles of the teacher and students. It spells out how students interact among themselves and with the teacher. This fourth element specifies who does what. It specifies if the teacher or the student initiate the dialogue process that generates the appropriate learning experiences.

The fifth element, Tools, lists everything needed for the unit including clearly defined software titles with appropriate references so others can easily locate them. Tools are the resources provided by the teacher to engage students in the act of learning and the creation of their own knowledge. They can include specific software programs, Web pages, reference books, and informational videos.

The sixth element, Standards, clearly states what the learning objectives are and links them to curriculum and technology standards across grade levels. The objectives also incorporate mandated district, state and national standards. All specific standards addressed are listed in the UOP. These standards delineate the expected student outcomes, as well as the criteria for evaluation of learning.

The seventh element is Assessment. This element of the UOP gives a clearly stated description of how students will be evaluated on the academic standards, goals and learning objectives set forth in the unit. The key question asked during the assessment process is: Did students meet the standards through their completed tasks?

An additional element was added in the PT3 Practicum Plus Program, an Abstract/Overview. This element provides a concise, clear summary of the content knowledge and skills expected of students. The Abstract/Overview gives other teachers a frame of reference as they look at the UOP online at the ACOT website and relate it to their own classrooms.

Assessment Procedure

The purpose of assessing each UOP is to objectively and precisely validate the design of instruction and technology integration. The assessment looks at participants' application in the UOP of standards and their integration of technology as a means for student learning.

UOP	Accomplished – 3	Developing – 2	Emerging – 1	Comments
Abstract/ Overview	Abstract is clearly stated and includes the content knowledge and skills students should know and be able to do. It is concise and clear.	Abstract is clearly stated, but lacks complete information students should know.	Abstract is too vague or general. The standards, goals and objectives are not addressed.	
Invitation/ Engagement	Motivates the student into the unit by relating to the learner's interests and goals; is engaging and matches the unit.	The invitation somewhat relates to the learner's interests.	The invitation is purely factual with no appeal to relevance or importance.	
Standards With Objectives	Content and technology standards are listed and referenced in the task and assessment components of the unit.	Content and technology standards are defined in general terms.	Content and technology standards are vague or not included.	
Tasks	Tasks are clearly stated, sequenced and easily understood for a teacher trying to duplicate this Unit of Practice.	Tasks are not clearly stated or sequenced.	A general list of the tasks is included.	
Interactions	Group dynamics and participants' roles are clealry stated. Teacher's role is defined. All are correlated with the tasks.	Group dynamics and participants' roles are stated but not clearly defined. Teacher's role is not clearly defined.	Participants and teacher's roles are not stated.	
Tools/	Required tools and	Most of the required	Required tools and	

Materials	specific software titltles are clearly listed and defined so that anyone could find the materials.	tools and specific software titles are listed, but not clearly defined.	specific software titles are not clearly defined.	
Situations	Situations are described in terms of location; time required per day, week, month or year; duration and physical environment	Situations are described in general terms of location, time or duration.	Location, time or duration is too vague or omitted.	
Assessments/ Evaluations	Description of how students have met all standards, goals and objectives is clearly stated.	Description of how students have met some of the standards, goals and objectives is stated.	Description of how students have met standards is vagues or omitted.	

Figure 1: Unit of Practice Evaluation Rubric

External evaluators, teacher education faculty and PT3 personnel having teaching and UOP experience, validate the UOPs through refereed review. They assess each UOP following a rubric (see Figure 1). The rubric, adopted and expanded from one used by the Arizona Learning Interchange (2000), provides a scale from 1 to 3, with 1 being the lowest, for assessing each element and the degree to which it was accomplished. The UOPs developed by preservice-inservice teacher teams can also be accessed through the ACOT website, fostering networking, collaboration and sharing of ideas and strategies across the United States and around the world.

Conclusions

Implications for the importance of the UOP lie in classroom teachers who are trained to break out of the textbook dependency mode, guiding students' learning through multiple sources of information. Training teachers to develop and use UOPs for instructional planning and delivery will invigorate learning for students by allowing their interests to help guide the lessons. Teachers will become empowered through increased confidence in technology integration, breaking away from games, drills and word-processing limitations.

The benefits for students are multiple. First, they are learning in a carefully thought through, sequenced course of study on a particular topic that addresses academic standards. They are learning to explore topics deeply, looking for and accessing information through a variety of sources. They are learning that the textbook is not the know-all, end-all for knowledge acquisition. Most importantly, they are developing technology skills that foster and promote research habits that will be useful throughout their educational careers and continuing in life after school.

To address the issue of low technology integration in classroom teaching, ASU West through its PT3 grant, is introducing student teachers and their cooperating teachers to the UOP as a way of planning for technology integrated learning. The presenters will share the nature of the UOP, how the pairs develop their UOPs to reflect standards, and how the UOPs are evaluated. The presenters will provide examples of UOPs and the evaluation rubric. Handouts will be available for the participants.

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Abstract: The purpose of this research was to examine the benefits of one-on-one mentoring for technology coaches and teacher preparation faculty as they learned to use technology. Participants included 33 teacher preparation faculty and 14 technology coaches, teacher education majors. The technology coaches worked with the faculty members in their offices and classrooms as they learned to use technology for their personal benefit and to integrate technology into their teaching. Interviews and observations indicated that coaches as well as faculty members gained in their knowledge of technology.

Faculties often need one-on-one, just-in-time assistance with technology as they learn to use it for their personal benefit and as they explore opportunities to use technology in their teaching. With the rapid increase in the available technologies, faculties are overwhelmed as they attempt to learn to use technology. Faculty development workshops provide a foundation upon which to build technology expertise (O'Bannon, Matthew, & Thomas, 1998). However, faculties also need just-in-time instruction as they attempt to use the knowledge gained from technology workshops and as they attempt to incorporate what they have learned into their teaching. MacArthur et al., (1995) found that technology mentors are one way to provide individualized and on-going support to faculty members as they move through the complex task of changing the way they teach to maximize the potential of technology to enhance student learning.

Dusick's (1998) review of literature revealed that several factors impact whether or not faculties use computers for instruction. These factors include: 1) administrative support, 2) computer availability, 3) resources, 4) support staff, and 5) training in the use of computers. Reporting on a three-year program focused on infusing technology into a teacher education program, Thompson, Schmidt, and Hadjiyianni (1995) identified these essential factors for success: 1) easy access to technology; 2) allowing faculty to become personally comfortable with technology before using it for instructional purposes; 3) having technology integration as a department goal; 4)

receiving strong support from the administration; 5) inviting participation in the program; and 6) one-on-one mentoring for faculty.

A national survey conducted by the International Society for Technology in Education (ISTE) commissioned by the Milken Exchange on Education Technology found that teacher preparation programs are not preparing teachers to effectively teach with technology (Moursund & Bielefeldt, 1999). Results of this survey indicate that teacher preparation faculty do not model technology use in part because they lack the skills to do so, and they lack the necessary hardware and software. Teacher preparation faculty includes faculty in the colleges of arts, sciences, and humanities many who do not recognize themselves as preparing future teachers (White, 1994).

In order for preservice teachers to integrate technology into their classrooms, they need to see it modeled in the university classes they are taking. Teacher preparation faculty in all content areas must model how technology can be integrated into the curriculum, not added on as an afterthought (Beichner, 1993). If preservice teachers are not required to use technology in their teacher preparation classes and they do not see it modeled by their professors, they will not use technology in their classrooms. Additionally, they must participate in classroom activities designed to provide experiences in enhancing instruction with technology to meet the individual needs of students. Through these experiences they will see the benefits and limitations inherent in teaching with technology. Preservice teachers will teach tomorrow the same way they are taught today (NCATE, 1997).

Faculty members who are not comfortable using technology for their own personal benefit are unlikely to integrate technology into their teaching. Stewart (1999) and Thompson, Schmidt, and Hadjiyianni (1995) found that one-on-one faculty mentoring assures faculty members receive the support they need to become comfortable using technology. Mentoring assures the faculty members receive individualized attention focusing on what they want to learn, a self-paced approach to learning, a comfortable setting, flexible times, and on-going support during the learning experience. Faculty members who participate in mentoring programs not only learn to use technology they are more likely to model technology use in their classes (Gonzales et al., 1999).

Faculty Technology Use

Faculty do not incorporate technology into their classes for a variety of reasons including, lack of access to appropriate hardware and software, limited technology skills, lack of knowledge of how to integrate it into their teaching, and lack of technical support. Lack of access to technology in university classrooms and faculty members' offices is often a major problem. However, when it is available faculty members need instruction on how to use the technology. Workshops provide them with the skills to use the technology, but do not provide them with the ongoing support needed to adapt the skills learned to their classroom teaching. Additionally, workshops often focus on teaching the technical skills, but do not show faculty how to integrate the technology into their specific subject area. Furthermore, in order for technology to reach its full potential, faculty members need to change the way they teach which is often not addressed in workshops.

Since faculty members have different work schedules they need to have assistance available when they are in their office, at flexible times. It is difficult for them to match their schedules to the times of scheduled workshops. Workshop participants are on a variety of technology levels and interests, so it is often difficult to provide the specific help faculty members need. One-on-one support in their offices and classrooms can be tailored to their personal interests and matched to their ability levels.

Each year students are arriving on college campuses with more technology and more technology skills (Olsen, 2000; Sheffield, 1996). When they see technology use modeled in some classes and find some course materials on the web they begin to question why other professors are not using technology and not placing course materials on the web. Hence, students are applying pressure to faculty members to learn to use technology and to incorporate it into their curriculum (Olsen, 2000; Thompson, Schmidt, & Hadjiyianni, 1995).

Technology Coaches

Thompson, Schmidt, and Hadjiyianni (1995) found that successful technology staff development included not requiring participation, but inviting participation and the use of one-on-one mentoring for interested faculty. One key to the integration of technology into teaching is ongoing coaching or mentoring for faculty after initial technology workshops as the transfer of skills to the classroom requires ongoing support (Ritchie & Wiburg, 1994). McKenzie(1991) found that faculty members need comfortable, familiar environments in which to learn to use technology as well as personal support. Faculty members want immediate help when they have problems, they want

help from someone with whom they feel comfortable, and they want just-in-time instruction specific to their own personal needs. Technology coaches meet with faculty in their offices where they have access to their own computer and coaches provide the faculty with personal support in a non-threatening manner as they experiment with technology.

A United States Department of Education Preparing Tomorrow's Teachers to Use Technology (PT3) grant provided funding for technology coaches to assist teacher preparation faculty as they learned to integrate technology in their teaching. Support staff for the coaches included two technology proficient College of Education faculty members. Through collaboration with another PT3 grant within the College of Education, technical support and instructional support personnel provided coaches and faculty with additional onsite assistance. The purpose of this research was to examine the benefits of one-on-one mentoring for technology coaches and teacher preparation faculty as they learned to use technology.

Methodology

Participants

Participants in this study included 33 teacher preparation faculty and 14 preservice teachers. Faculty members (33) from the College of Education, College of Applied and Natural Sciences, College of Liberal Arts, and the University Lab School received one-on-one assistance from the technology coaches. Three of the coaches were married with children, one was married and pregnant, one was married, one was a single mother, and the remaining eight coaches were living at home or in a dormitory on campus. The coaches were 14 full-time female preservice teacher education majors who had completed the required teacher preparation technology course and had a high interest in learning more about using technology. During the 1999-2000 academic year there were eight technology coaches. During the summer 2000 there were nine technology coaches, three of who had been coaches during the academic year.

Procedure

At the beginning of the fall quarter professors who taught the initial technology class recommended students they felt were proficient in technology. Since many of the technology coaches would not be attending summer school, additional coaches were recruited during the spring Kappa Delta Pi initiation. Some students applied to be technology coaches after hearing about the positions from other students and learning that the salary was above minimum wage. Students were asked to complete a form indicating which hardware and software they had previously used and to indicate their proficiency levels. Students were also asked to provide information as to when they were available to work with faculty within the 20 hour per week limit set by the university. Students were reminded to not miss classes in order to work with faculty and to allow themselves enough time for studying.

The availability of the technology coaches was introduced at department and lab school faculty meetings and through memorandums placed in faculty mailboxes. Faculty members were asked to complete forms indicating the areas in which they needed assistance. They were reminded that the coaches were there to assist them in using the technology, rather than to complete projects for them. Forms completed by the coaches and the faculty were used to match student expertise with faculty needs.

In order to assure that the coaches had the necessary skills to assist faculty, opportunities were provided for them to work through tutorials and attend workshops on *HyperStudio, Microsoft Office, Inspiration*, and *Netscape Composer*. When faculty requested assistance with graphics, email, and using a digital camera, coaches were given individual instruction prior to their meeting with the faculty member. Coaches were at first concerned about their limited technology expertise. They were assured that they were not expected to know all of the answers and that support staff was available to assist them in finding the answers. They quickly learned that the support staff did not have all of the answers. However, they also learned that the support staff worked together to find the answers they needed and helped them to learn the skills they needed to assist the faculty. As new software arrived for the faculty computer lab and the campus model technology classrooms, students assisted in the installation, learned to use the software, wrote up step-by-step directions for using the software, and worked with faculty members as they used the software with their students.

Faculty development workshops were provided to preservice teacher education faculty during the day and after school for the university lab schoolteachers. The coaches attended the workshops and provided support to the faculty members during the workshops. The workshops provided opportunities for the coaches and faculty members

to meet one another. Relationships formed during the workshop were often continued as faculty members requested that the students work with them in their offices and classrooms. Faculty workshops in the College of Education were not well attended, however, faculty members were interested in having coaches work with them one-on-one in their offices and classrooms. Lab schoolteachers attended workshops in their school library as part of their monthly faculty meetings and appreciated the opportunity to learn to use technology while working with one another.

Coaches worked with faculty in their offices on their own computers, which provided a safe, comfortable environment for the faculty as they were familiar with the software on their own computer. Coaches assisted faculty members as they attempted to use skills learned in workshops. Simple things such as differences in the configuration of the toolbar between the computer used in a workshop or the computer in another faculty member's office and the computer in their office frustrated faculty members as they learned new skills such as centering or underlining text. Coaches were also available to assist faculty in their classrooms as they learned to use the multimedia carts for classroom presentations. These carts contain a VCR, speakers, document camera, laptop, and a presentation system and had to be checked out prior to class and returned after class. In addition to being overwhelmed by the buttons, cables, and keys, faculty members soon discovered that since the equipment on each cart was from different manufacturers the configuration and the setup varied. If they could not check out the same cart each time, they were faced with figuring out how to operate the equipment on the available cart.

Some faculty were interested in learning to create their own web pages and placing course materials on line. Coaches varied in their ability to create web pages and they were given additional instruction in web page design and development. A simple web page template was designed and placed on the College server so that the coaches could download it directly onto the faculty member's own server space. Instructions on placing web pages on the faculty member's server space were developed for coaches. Faculty members were given directions on how to locate, maintain, and edit their web pages.

With the opening of three distance education classrooms the need for proctors became evident. Since funding for distance education proctors was not available, technology coaches were asked to proctor the classes. Convinced that knowledge of teaching via compressed video would be beneficial to them professionally, students volunteered to learn to proctor the classes. Since many of the distance education classes were taught at night, this provided students additional work opportunities that did not conflict with their university classes. The director of the campus Center for Instructional Technology and Distance Learning (CITDL) and his staff conducted a proctoring workshop for the technology coaches. Additionally, on the first class meeting one of the grant support staff worked with the coaches to assure that the equipment operated correctly and that the coach was comfortable with the assignment.

Technology coaches were asked to write down a brief description of their visits with faculty members and to have them sign the forms to verify that the student had worked with them. Faculty members were also provided separate forms for comments to send directly to the grant director about the mentoring sessions. Interviews with the faculty and the coaches conducted by an external evaluator and grant personnel provided additional data about the mentoring process.

Results

Interviews with and observations of teacher preparation faculty and technology coaches indicated that both showed growth in their technology skills, which led to them feeling more comfortable using technology and more willing to incorporate technology into their teaching. The coaches were at first intimidated by the prospect of teaching their professors and because they felt they did not have the expertise needed to teach someone to use technology. However, faculty members and coaches soon developed a working relationship. Since the coaches did not know everything about technology, the faculty felt comfortable asking for their help. One student commented that she thought the faculty felt comfortable working with the coaches, because they were not "techno-experts." The coaches accepted the faculty at their level of technology expertise and tailored the instruction to meet the needs of the faculty member. However, two coaches were rather disconcerted to discover that a faculty member did not know how to type and did not know the location of the keys on a keyboard.

Faculty members expressed appreciation for students helping them learn to fully utilize their office computers, such as organizing files on their computer hard drives, sending email attachments, using spreadsheets, and writing down instructions for the faculty member to be able to do things on their own. The coaches worked to accommodate faculty members' schedules; however, they were frustrated when faculty members set up appointments and then failed to keep them. The coaches came to understand that faculty members' schedules were often beyond their control.

One coach worked with a professor loading math software on a laptop computer on the multimedia cart and assisted the professor as the software was demonstrated for the students. This student then made herself available for her classmates as they worked problems in the computer lab using the software and printing out their answers. Another coach learned to use several pieces of early childhood software and then worked with the professor in her classroom as she used the software with her students. Several professors asked for assistance learning to use PowerPoint and to create slide shows for their conference presentations. Coaches were successful in teaching faculty members to use PowerPoint, but were less successful teaching faculty members about design issues. Coaches reported that faculty members insisted on putting excessive amounts of text on the slides in small font and including distracting sounds and animations. Jarring colors, small fonts, and irrelevant animations were also a problem with faculty web pages.

At first the cameras, microphones, monitors, computers, document cameras, fax machines, telephones, and VCRs in the distance education classrooms were overwhelming to both the proctors and the professors. However, they soon developed a routine for working together and operating the equipment. One student became particularly adept at moving the camera and operating the equipment and took great pride in her work. Although no longer employed as a technology coach, she volunteers her time whenever she is registered in a distance education course. During the summer session one professor overwhelmed by the prospect of using any technology was assigned two proctors for his compressed video class. The students at the distant site continually asked to see his notes on PowerPoint slides saying that it would be easier to follow along. The professor resisted until one of the coaches assured him she could create a slide in less than a minute and then proceeded to do so. Knowing that they were to teach the professors rather than do everything for them, the proctors insisted that he create one or two slides for each class and they would complete the others. The two coaches enlisted the assistance of other coaches and they all worked together to create PowerPoint presentations for some of the professors other courses. At the end of the class the professor took the students to lunch and he continues to maintain close contact with the students as they complete their teacher education program.

The individualized attention and on-going support of the coaches facilitated faculty members' growing expertise and use of technology. Having assistance available in their classrooms when working with their students encouraged faculty to weave technology into their teaching. Some faculty members did make changes in their teaching by allowing students to work together and solve problems using technology. Some faculty members saw the potential of technology to enhance their teaching and continue to ask to learn new ways to use technology. For example one faculty member with the assistance of a technology coach created her own web page and was ready for another challenge, so she decided to establish a listserv to use with her students. Other faculty members simply created web pages and put course syllabi on-line with no appreciable change in their classroom teaching. Some faculty members had a difficult time understanding that with all the different configurations of computers in the College what coaches learned to do on the computers in the lab may not work on the faculty members' office computers. For example, one faculty member's office computer did not have sufficient memory to work with graphics.

Overall the technology coaches indicated that after working with faculty they felt more comfortable using technology and had gathered ideas for using it in their own classrooms. During interviews three of the coaches expressed interest in obtaining a master's degree in instructional technology. One coach graduated in May, immediately applied for the master's program, and continued her work as a technology coach during the summer. Over the summer she spent time using the computers and printers to create things for her classroom and to plan activities for her new students.

The technology coaches developed a sense of pride in their technology expertise and developed problem solving skills as they encountered hardware and software problems. Coaches learned to move between Macintosh and Windows computers with ease and became familiar with a wide variety of software for use in their classrooms. The teacher preparation faculty and their classmates see the coaches as valuable resources. A real commitment to their work was evidenced by the discovery that many of the coaches were working at home and on weekends to learn to use technology to help the professors and were working on projects for the professors on their own time.

Conclusions

The adoption of technology is a complex process that takes time and resources in addition to requiring ongoing individualized support. The results of this research supports the research of the others (MacArthur et al., 1995; Gonzales et al., 1999; Stewart, 1999; Thompson, Schmidt, & Hadjiyianni, 1995) regarding the benefits to faculty of having one-on-one mentoring as they model the integration of technology in the classroom curriculum. One-on-one assistance in their offices provided faculty members the support they needed to become comfortable using technology, an essential first step to using technology in their teaching (Thompson, Schmidt, & Hadjiyianni, 1995).

As evidenced by the students in the distance education class who requested that the professor use PowerPoint presentations, students are applying pressure to faculty to incorporated technology in their teaching (Olsen, 2000). Having preservice teachers mentor teacher preparation faculty benefited both groups as they worked together to learn to use technology for their own personal benefit and in their teaching. Furthermore, they established positive relationships that continued after the mentoring ended.

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Lessons Learned

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Abstract:
Last year our School of Education received a PT3 Capacity Building grant. This year we received a PT3 Implementation Grant to continue our work with integration of technology into our teacher preparation program. In addition, last year we received a 5 year Title II Partnership for Teacher Enhancement grant to assist us redesign our teacher education program. The PT3 grants support this effort.

A panel of university faculty will interact with the audience as they share their experiences on lessons learned and the continuous assessment that occurred during this period of change.

Overview:

The University of Alaska Anchorage School of Education (http://www.uaa.alaska.edu/ed/) has been redesigning its teacher education programs. The goal of the redesign was to provide preservice students with an education that meets the needs of educators in Alaska and to provide practicing educators with ongoing professional development support. An additional goal was to be able to become NCATE accredited.

A five year Title II Partnership for Teacher Enhancement grant, Alaska Partnership for Teacher Enhancement (APTE), provided assistance with the redesign our teacher education program. UAA, through the APTE Title II partnership grant is creating a post-baccalaureate Professional Development School model. Four schools in Anchorage and 5 schools in the rural school districts have been identified for the 2000-2001 school year. In addition, the APTE program will be developing a distance-delivered program for village teacher aides that will lead to a Liberal Arts Bachelor's degree and elementary teacher certification. The APTE grant allowed School of Education faculty to interact with Pre-K to 12 faculty, administrators and private sector partners. The first task was to create a new post-baccalaureate program and begin implementation within one year.

In addition to this major task, faculty were being asked to integrate technology in their classes. The Alaska PT3 grants assist with this process. Our PT3 grant addresses four specific goal areas: Program Development, Faculty Development, Student Development, and K-12 Partnerships. They are part of a systemic change in teacher education and linked to each other and to other projects and programs within the SOE. These are the goals of the PT3 grant.

STUDENT DEVELOPMENT: SOE GRADUATES will be well prepared, technology proficient educators.

FACULTY DEVELOPMENT: SCHOOL OF EDUCATION AND CONTENT AREA FACULTY will be knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship.

PROGRAM DEVELOPMENT: SCHOOL OF EDUCATION PRESERVICE TEACHER EDUCATION PROGRAMS will reflect best practice including the integration and modeling of technology in all courses, using distance technologies to erase the differences between urban campus-based and rural programs.

K-12 PARTNERSHIPS: SCHOOL DISTRICTS WILL BECOME FULL PARTNERS in new teacher preparation through mentor teachers modeling best practice supporting pre-service year-long internships and shared training activities.

To help faculty members develop the vision needed as they experiment with using technology in their current courses and model use of technology in the field, as part of the 1999-2000 Capacity Building project, UAA faculty members participating in this project have already received laptop computers with software comparable to what the students have in the SOE lab. A small projector and "smart cart" with student laptops is now available for check out.

One immediate benefit of the PT3 Capacity Building year has been increased awareness of technology integration into instruction. The team building resulting from UAA sending 10 people (SOE, CAS, ASD) to the SITE conference in February 2000 was a pleasantly unexpected outcome of this activity.

Faculty were asked to think about the lessons they have learned from these experiences. Those attending the SITE conference in March 2001 will participate in this session by sharing lessons they have learned.

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Bootstrapping Online Organizational Knowledge: Technologies and Practices from a PT3 Initiative.

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Abstract: Large-scale projects often depend in critical ways on points of leverage where modest effort has significant influence on outcomes. The purpose of this paper is to describe how a coordinated system of Web resources served as such a point of leverage in a federally-funded effort to promote technology in support of teaching and learning. We believe two other decisions were important in the success of our Web tools as a point of leverage. One decision was to avoid high-tech proprietary systems (i.e., "groupware") in favor of a loose collection of relatively "low tech" tools. The second was that we sought to build on, rather than replace, existing workplace practices and protocols. We believe these decisions also significantly enhance the generalizability of the model we have developed for preparing teachers to teach in an information age.

Introduction

Initiatives in teacher education are complex enterprises that typically involve large numbers of participants and a wide range of constituencies. In addition to technical issues related to curriculum, credit hours, and certification, there are many practical matters related to working practices and protocols in university and K-12 academic settings. Given such circumstances, it is critically important that initiatives intended to promote institutional change establish a broad collaborative base of knowledge from which change can emerge. This paper describes how "low-tech" Web technologies have been applied to create and support the development of a collaborative organizational knowledge base with the objective of promoting in-service and pre-service teacher development in the area of technology integration.

Although it has become something of a straw figure, it may still be useful to emphasize that technology integration that relies simply on investing as much as we can in the latest hardware and software is not likely to lead to desired outcomes. There is ample evidence that simply introducing new tools in the absence of continuing support will be unproductive (Maddux, Cummings, & Torres-Rivera, 1999; McGregor & Pachuski, 1996; Bork, 1995). Moreover, teacher educators and the institutions they work within have well-established workplace protocols and practices that reflect local needs and knowledge (Walters & Pritchard, 1999; Slick, 1998; Maddux, Johnson, & Harlow, 1993). Depositing the "latest and greatest" technologies in a teacher's classroom may be the equivalent of sending a tractor to a third world farmer who has no ready access to gasoline. In principle, it has utility, but it presupposes a context that is missing. Teacher education initiatives are further complicated by the fact that they almost invariably are required to bridge institutional boundaries (Slick, 1998). Efforts to revise a curriculum will often require participation by state licensing offices and field placements and internships can only be arranged working with colleagues in PK-12 school systems (White, 1994). Even purely physical constraints can result in serious obstacles to reform when participants are scattered across school systems, cities, and states.

As participants in a federally supported Preparing Tomorrow's Teachers to Use Technology (PT3) project, we were eager to begin but wanted to be sure to coordinate our efforts so that our work could effect institutional changes that would not disappear with our federal funding. From the beginning, we felt that the power of the Internet (and specifically, the Web) would be central to our efforts. At the conclusion of the first year of work it is now clear that, if anything, we underestimated the potential of the Web as a platform for our efforts.

Project Overview

Our project has three major objectives, all related to technology integration in PK-12 or post-secondary classroom settings.

1. Assist pre-service teachers in developing teaching styles that make effective use of technology.
2. Promote pre-service teacher experience with technology-enhanced learning in their own education.
3. Establish a model for technology integration that can grow and change as technology evolves.

Our project achieves these objectives within a training and internship program that places digitally literate pre-service teacher education students as technology consultants with established public school and university educators interested in learning more about technology integration. This consultant/client model is designed to introduce new teaching and learning technologies in a mutually supportive collaborative environment that benefits the pre-service interns, the teachers with whom they work, and the students in the classrooms where technologies are introduced. The project is also intended to develop a broader, more flexible model for technology integration to ease technology transitions for individuals and institutions in a variety of settings.

We believe the ultimate success of our efforts will be demonstrated by the extent to which tools and practices we develop are institutionalized in our programs and in our collaborative interactions with field-based colleagues and school systems. As a consequence, we made an early choice to adopt a collection of inexpensive and widely used "low-tech" tools (email, listservs, discussion boards, Web pages, and WebCT, a course development and delivery system) to build a foundation for our project knowledge base. Our decision to opt for a "low tech" approach had a number of important consequences for us.

One consequence was that most project participants were already familiar with many tools we had chosen, an important benefit in getting project activities started. A second more complex consequence was that, since most participants used the tools we had adopted, they had already established practices and protocols for this use. While this sometimes was an advantage, it occasionally resulted in problems since established patterns of use could run counter to our objectives. One instance where this led to some difficulties was where students had come to rely on workplace Internet access rather than on the access provided by the university. Practices and protocols that might be appropriate in a workplace setting (e.g. no Internet downloads) could make essential project activities impossible, even when employers were sympathetic to our objectives. Finally, a third consequence of our choice to use "low-tech" tools was that institutionalization would not require resources to support specialized hardware or software when external funding ended. The success or failure of the institutionalization effort would thus depend on *practices and protocols for technology use* we could develop, not on resources we had managed to accumulate when outside sources supported our work.

In the fall of 1999, project activities began with participants from Oakland University (OU), Michigan Virtual University, Pontiac City Schools, and Rochester Community Schools. The working groups we established included OU faculty and students, colleagues from the Michigan Virtual University, and local school administrators, including technology coordinators, and an assistant superintendent for curriculum. We began our work by identifying expectations, points of contact, and participant roles and responsibilities. Although the implementation of the project would not begin until the following term, it soon became apparent to us that that the Web-based systems we planned to use in supporting our technology consultants would probably be equally important to us in planning, coordinating, and documenting project activities. Our online information and document management systems thus became an important early priority.

In January 2000, we began creating technology and content components that would be a part of the course for the student technology consultants. A small group of 8 students helped us pilot this new 4-credit course, co-taught by faculty from Instructional Systems Technology and Human Resources Development. From January to June of 2000 we broadened our technology base and significantly expanded the "content" we could deliver. By mid-winter our Web server was fully operational, the Web development team had created a wide range of project support materials, and the outlines of our broader framework for information management and distribution were established. In the fall of 2000, our first full class of technology

consultants began working with teachers at the university and in our two participating school systems.

Building a Foundation for Knowledge

Well before our first group of technology consultants began their work in the field, we had come to the realization that our success would depend on capturing what we were learning in a well-organized and accessible knowledge base. It was clear that, given our existing workplace practices, documents would be a central element in our knowledge base. Proposals and planning documents had been the foundation for our future work and had helped us establish timelines and assess progress. We also expected to produce a variety of user guides, project reports, and research papers. We were also well aware that managing the flood of paper generated by a large-scale project like ours could be difficult. Distribution of printed documents would create unnecessary and unproductive duplication, requiring participants to manage their own hard-copy document archive, as well as inviting versioning problems that arise when multiple drafts of a document are circulated.

One approach to solving these problems is to create a single centrally managed print document archive, but this approach is usually expensive and relatively inflexible, as a result of the administrative infrastructure that must be created to support intake, registration, and distribution. We opted for an alternative "distributed" approach to document management that allows individual project participants to submit, review, and retrieve documents through our project Web site. The foundation of this distributed approach is a database system that helps us organize materials, while it simultaneously solves problems related to versioning and duplication by providing a single readily accessible but authoritative source. One advantage we had in considering how we might manage the documents produced in our project was the fact that we had immediate control over our Web site, since the project Information Services Coordinator was also the server administrator. It has been our experience, however, that while this degree of control can confer some advantages (e.g., we can rely on our operating system to manage user access), the methods we have developed do not depend on this arrangement. Although working both sides of the traditional IT "divide" has given us an appreciation for the role of technology administration, our decision to emphasize low-tech tools meant we were looking for generic tools that would not require special server access.

Our server platform is a Windows NT machine running Microsoft's Internet Information Server 4.0. One feature of this platform that has been central to our project is its support for Microsoft's Active Server Pages (ASP), an environment for integrating a variety of server-side scripting languages into our Web site, and Microsoft's ActiveX Data Objects (ADO) that support our database connections. Fortunately, however, these technologies provide relatively straightforward methods for creating dynamic database-driven pages without sophisticated programming skills, an important element in making our methods generalizable. Moreover, these techniques can be implemented in a step-by-step incremental fashion that helps those involved in developing and delivering information services acquire skills as they bring new capabilities online.

Overview of the Web-based Systems

As illustrated in Figure 1, our Web-based information system includes two main components, a document management system (DMS) and a course delivery system (CDS). The DMS runs on our project Web site, while the CDS (WebCT) runs on a university server. One disadvantage of assembling project-specific and university resources as we have done is that it requires participants to manage multiple user accounts (for access to different components), but we have not had problems with users managing accounts. Moreover, although these systems are distinct, we have found that information is easily shared since both components are Web-based resources on our local university network. While this arrangement limits our control somewhat, it also means we do not need to manage the CDS, a complex software system. All things considered, we believe our distributed approach has important benefits for both the sustainability and generalizability of our model.

Figure 1 provides an overview of our Web-based systems. Rectangular regions represent users, oval regions represent information, tools, and documents, and arrows represent the flow of information. Some groups are exclusively "consumers" of information, while others also contribute information to the system.

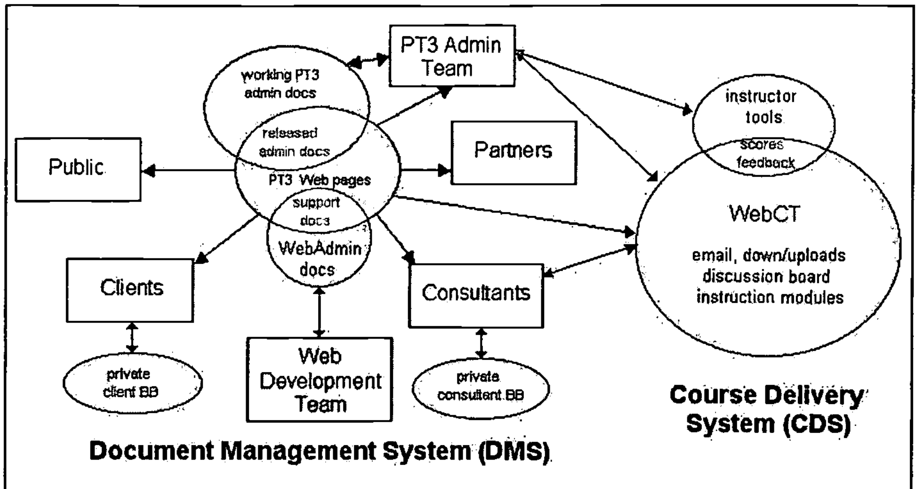

Figure 1. Web-based systems for support, administration, and instruction.

Both the Web Development Team and the PT3 Administrative Team, for example, are linked to the DMS with double-headed arrows indicating they receive *and* contribute to this resource. Likewise, both Consultants and the PT3 Administrative Team are linked to the CDS, indicating that these groups participate as both consumers and contributors. In effect, these double-headed arrows represent the interactive elements in our system, places where participants contribute as well as consume information.

The DMS includes five main types of documents. The oval at the top represents documents created and contributed by the PT3 Administrative Team, the group of that leads the project. This part of the system supports operations that are "internal" to the administrative team. Most documents created by this group start out as restricted-access "working" materials, available only to other members of the administrative group. Some of these documents are, however, eventually moved out into the public area. The lowest central oval in the DMS represents a part of the system set aside to support development of support materials. Since members of the Web Development Team have primary responsibility for authoring these materials, this group has authoring privileges and is linked to the system with a bi-directional arrow. As with the administrative materials, support documents are initially held in a restricted-access region but usually move quickly into the public-access region. The final elements in the DMS are private, password protected discussion/bulletin board areas intended to promote and support *private* interaction within the client and consultant groups. As indicated by the arrows, only members of these groups have access to their respective discussion boards.

As indicated on the right side of Figure 1, the course delivery system (CDS) involves two participant groups, consultants and the administrative team. As a part of their project participation, consultants register for a 4-credit consulting course that helps them establish effective working relationships with clients (i.e., participating teachers.) Since our online courseware includes a variety of interactive features, both consultants and members of the administrative team who co-teach the course are linked with a bi-directional arrows.

Some Participant Perspectives

From the Project Director

As project director, my role is leading, coordinating, and making sure that all of the individuals involved have what they need. In order to do this effectively, I need relevant information about all aspects of the project and continuous two-way communication. Because my responsibilities also include teaching our student consultants, I am also in continuous communication with the students. I consider on-demand access to information resources and computer mediated communication essential ingredients in the success of our project. Our Web-based systems make my job much easier.

While our Web resources certainly facilitate the work of the PT3 administrative team, I am most fascinated by observing the use of resources by our student consultants. There is no question that they are personally experiencing the possibilities technology offers in support of learning. Our students have come to consider themselves a community of learners. They build on each other's knowledge through discussion boards and classroom interaction. They often answer each other's questions and provide one another support when challenges arise. They use the technologies at their disposal as just-in-time tools instead of just-in-case last resorts. Perhaps most important of all, they are not learning about technology integration in the abstract, they are actively applying technologies to meet personal learning needs in a way that will transform both their view of the tools and their ideas about teaching and learning. Although it is still too soon to know for sure how their experiences in the project will influence their future professional practices, what we see suggests they will be less likely to limit their future students to a "book learning" model.

Although we are pleased with the tools we have developed, what we have learned about how to more effectively support student learning leads us to conclude that we must continue to expand and develop the communication and information resources we deliver online. Administratively, we have created models that help us manage programs and create, store, and retrieve knowledge more efficiently and effectively. Further, I think we will find that many of our administrative Web resources will evolve into classroom learning support tools – teachers morphing into learning team managers – that's an interesting thought to ponder!

From the Web Development Team

The primary focus of the Web team is to create support materials for use by consultants and clients. We began by identifying common technology tasks (e.g. how to create a Web page using Netscape Composer) and then created (or linked to) support documentation. For the most part we worked independently. An online "job board" (part of our WebAdmin site - see Figure 1) allowed us to choose a task, keep work records and, ultimately, upload the final version of our completed support material into our "PT3 Problem Solver Database."

In addition to regular Web team meetings, one team member attends meetings with consultants. This provides us an important user perspective on our support system, helping us learn how documents are being used, which documents are the most useful and what, if any, problems are encountered. We are also testing documentation in face-to-face consultant workshops in an on-campus computer lab. Hard copies of documentation are distributed to each consultant at the workshop. Consultants use the documentation as a primary learning resource to acquire new technology skills while Web team members observe their use of the documents. Consultants have an opportunity to raise questions both on a one-to-one basis as they work at a computer or in a group debriefing session immediately following hands-on learning. We have been very pleased with the quality of the feedback consultants have provided us, particularly in our workshop sessions.

From Student Consultants (based on interviews)

Overall, student consultants seem very pleased with the resources they are provided. Our discussion boards systems seem to have had the greatest influence in reshaping the way these students think about their learning. The students have begun using phrases such as "community of learners" in describing their experiences. Although one of our two discussion boards is private (the one in the DMS), we know from server stats that they are using this resource. Moreover, based on their comments in interviews, they appear to be differentiating their use according to their perceived role. Discussions that focus on consultants' roles as students appear more commonly on the CDS discussion board, while those that deal with field–based issues related to their roles as consultants appear more likely to crop up on the DMS discussion board.

When asked about whether they felt their PT3 experiences were likely to change their classroom teaching practices, consultants expressed strong opinions that their use of technology will be dramatically different that what it would have been, had they not participated. Consultants indicated they felt they had crossed both a "confidence threshold" and a "competence threshold", in addition to developing practical skills

and ideas about integrating technology in classroom settings. It appears that fundamental mental shifts have taken place in the awareness of PT3 consultants concerning teaching, learning, and technology.

Summary and Conclusions

As a result of our Web-based management tools, project participants can interact and share their work with one another through the project Web site. Working groups usually have short weekly face to face meeting to talk over issues but our document management system has helped us automate processes that can be time consuming and error prone. Web Development Team members can select "jobs", track and annotate their work, record hours, and ultimately submit the work they complete (primarily support documentation) directly into the DMS, where it can be accessed by other project participants. A job completed and uploaded becomes immediately available to everyone else, something that seems to reinforce the important idea that the team is developing materials for users, not for their team leader. Our administrative systems have promoted the same sense of immediacy and audience in our project management materials and in the future we expect to initiate a similar consultant management system to help track and support our consultants who are working in the field.

We believe that our success thus far is due in large part to three factors. One factor is our decision to build our knowledge systems around Web technologies. A second factor is our decision to avoid high-tech proprietary systems (i.e. "groupware") in favor of a loose collection of relatively "low tech" tools (e.g., Microsoft Office, email, bulletin boards, and Web-enabled Access databases). And the third (related to the second) is to build on, rather than replace, our existing workplace practices and protocols. We also believe the model we have developed will generalize effectively. It requires only modest tools, modest levels of expertise, and modest changes in the working practices of participants. Once created, the technological and cognitive infrastructures that support the system are easily maintained and can continue to develop incrementally.

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USING A SURVEY TO DESIGN AND EVALUATE PROFESSIONAL DEVELOPMENT ACTIVITIES

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Abstract: To implement our PT3 grant, we needed to answer three questions. First, we needed to identify the current level of computer skills in our faculty, both at the University as well as in two public schools that are participating in our grant. Second, we needed to know how the faculty were currently using computers in their teaching. And third, we needed to gain information regarding the faculty's attitudes toward integrating technology in education. This paper discusses the development of a brief survey questionnaire that can be used to help design computer support services and training workshops, help individual teachers and professors design professional development plans, and help administrators and program evaluators assess the effectiveness of these types of professional development activities. The paper will also show how survey data of this type can be used to help identify how receptive a group of educators is to increasing the role of computers in the curriculum.

To implement our PT3 grant, we needed to answer three questions. First, we needed to identify the current level of computer skills in our faculty, both at the University as well as in two public schools that are participating in our grant. Second, we needed to know how the faculty were currently using computers in their teaching. And third, we needed to gain information regarding the faculty's attitudes toward integrating technology in education.

This information was needed to serve several purposes. We had to assess the faculty's current computer skills as well as their use of computers in their teaching in order to design support services and training workshops that would meet their needs and be well received and utilized. This information was needed to design workshops and support services for the faculty as a whole as well as for designing individual professional development plans. We wanted to gain an idea of the faculty's attitudes regarding the integration of computers in education for the same purposes, but also to gauge how receptive the faculty might be with regard to increasing the role of computers in the curriculum. It was also very important that we would be able to measure the effectiveness of the grant activities, so we needed an instrument that would provide useful baseline and follow-up data.

A literature search found no available questionnaires which could serve these purposes well, so we incorporated some of the best approaches from other instruments to create a comprehensive questionnaire that is brief and user-friendly but still provides useful information. Initial statistical analyses of the 23-item questionnaire have found scores on the instrument to be psychometrically reliable.

Our PT3 grant is focused on increasing faculty use of computers at both the K-12 level and the university level, so we have used this survey questionnaire with both K-12 teachers as well as the professors who teach the students in our teacher preparation program. To date, the entire faculty at two local public schools and the entire teacher education faculty at the University have completed the survey, and we are beginning to survey all of the faculty in

the College of Arts and Sciences and the College of Communication. The data currently being collected will serve as baseline data, and the questionnaire will be readministered annually to help establish the effectiveness of the activities undertaken as part of our PT3 grant.

This paper will demonstrate how a brief survey questionnaire can be used to help design computer support services and training workshops, help individual teachers and professors design professional development plans, and help administrators and program evaluators assess the effectiveness of these types of professional development activities. In addition, the paper will show how survey data of this type can be used to help identify how receptive a group of educators is to increasing the role of computers in the curriculum.

Forming a Cadre of Learners: Effective Educational Technology Integration in a Teacher Preparation Program

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Abstract

West Chester University's USE-Tech Partners (PT3) program has been a catalyst for increasing interest in and cooperation for preparing technology proficient teachers. Project activities during the capacity-building year included monthly participant meetings, development of integration strategies by faculty, consortia partnership development, completion of the university technology plan, and project evaluation activities. Nineteen participating faculty had released time during the Spring semester or Summer of 2000 to develop and test integration strategies in one or more of their courses. Faculty enhanced the learning of preservice teachers through: e-mail, the Internet and web-based learning applications (e.g., BlackBoard), content specific software, presentation software and other productivity tools, and video-conferencing.

During the past year and a half West Chester University's (WCU) Preparing Tomorrow's Teachers to Use Technology (PT3) grant, (the **USE-Tech Partners,** University-School Educational Technology Partnerships grant), provided funding and focus to technology integration. The program is working to ensure that all teacher candidates are able to integrate technology effectively into classroom instruction. Our vision is to use this capacity-building grant as a springboard for making WCU a model in preparing technology-proficient teachers, and to become a school that attracts the best teacher candidates and is closely connected to the K-12 schools we serve. The first year activities of this PT3 grant laid the groundwork for ultimately achieving a two-part goal, namely, *the modeling of technology integration by WCU faculty in both methods and content area courses, and the achievement of specified technology competencies by preservice teachers*. The grant, a catalyst for greatly increasing interest in and cooperation for preparing technology-proficient teachers at West Chester University, has formed a cadre of learners including university and K-12 administrators, university faculty in the School of Education and the College of Arts and Sciences, preservice teachers, K-12 students and teachers, and business members which joined together in these technology integration efforts.

The USE-Tech University Partners Program Activities

Project activities during the capacity-building year included monthly participant meetings, development of integration strategies by faculty, consortia partnership development, completion of the university technology plan, and project evaluation activities. A program extension has been granted by the Department of Education and a new application is being made for a PT3 implementation grant so that this work can continue to expand -- "scaling up" the positive impact on preservice teachers and inservice teachers documented through collected data.

Nineteen participating faculty had released time during Spring semester or Summer of 2000 to develop and test integration strategies in one or more of their courses. They enhanced the learning of preservice teachers through: e-mail, the Internet and web-based learning applications (e.g., BlackBoard), content specific software, presentation software and other productivity tools, and video-conferencing. Four categories of faculty support, i.e., released time, frequent meetings to share successes and challenges, workshops and training sessions, and ongoing support of individual learning, were essential to learning how to integrate technology into the curriculum.

In a state-funded higher education institution such as WCU, faculty are expected to produce scholarly work, serve the university, students and community; and teach a full 12-credit course load. Release time from this hectic schedule is not easily found. The alternative work assignment (AWA) 3-credit course relief provided by this grant was seen as a valuable and rare support by all of our 19 participants. Having adequate time to work on appropriate technology resources that would support their teaching was appreciated by every faculty member.

Through regular gatherings of USE-Tech faculty participants found a supportive environment during which participants shared successes and challenges related to their work with technology integration for more effective teaching and learning. These meetings established a forum for faculty members to talk about technology issues in new and productive ways and learn from one another in a collegial setting.

A week-long workshop, the "USE-Tech" Winter Institute, was held at West Chester University in January 2000 and included visits by guests (consultants) from other universities. In addition to the opportunity to speak with other higher education faculty who have successfully included technology in their own teaching, West Chester University USE-Tech participants enjoyed, hands-on workshops related to their own personal goals. Ongoing support for faculty learning is provided through the Faculty Technology Center (FTC), and includes workshops and just-in-time support from staff and students.

Collaborative planning sessions included: consortium members, additional members of the WCU academic community, and representatives of the K-12 School Districts we serve. Groups within the university, K-12 school districts, businesses, and community are working toward a common goal of integrating technology into teacher preparation as a result of project activities. An objective of this project was to have collaborative partners agree to support the project, and identify roles and responsibilities. Written agreements of participation, roles and responsibilities already include 7 school districts, and 5 business/community groups. As a result of our USE-Tech efforts we have successfully expanded our goals in the area of collaboration to include the introduction of a new graduate educational technology certificate program, the "*Teaching and Learning with Technology*" program designed for inservice teachers from local school districts, and the creation of a proposal for a PT3 implementation grant. University collaboration led to renovation of technology facilities in the School of Education during the summer of 2000.

Lessons Learned from the USE-Tech Program

Baseline survey data on faculty skills and use of integration activities was collected at the beginning of this project in the Fall of 1999. Attendance numbers and a rating of on-going professional development activities have been collected. End of the year survey data on faculty skills and use of integration activities will be collected by the end of the Spring term, and interviews with faculty regarding their experiences are now being completed. Some the findings of this grant include the following:

- As faculty become more adept at the use of technologies, they become more comfortable with taking informed risks in their teaching; expansion of original technology goals was common.
- Although much of this professional development and support work has been accomplished by USE-Tech staff, some has also been done through the collaborative effort of participant-teams and through the use of existing university resources, such as: training offered in the SOE by a university web instructional specialist. Existing university resources have been better utilized when project faculty have learned about them from their project colleagues.
- Faculty become more interested in technology when they see students using technology -- preservice teachers and K-12 students and teachers.

- Making technology easily accessible to students and faculty enables its effective use for enhanced teaching and learning environments. Easy access to technology when and where it is needed is very important for higher education faculty.
- Faculty members experience different parts of the shared vision for technology integration -- time is needed to communicate these ideas with one another.
- Released time is a good incentive for faculty for the specific purpose of improving technology skills and integration of technology. Faculty need and appreciate the time allocated for their professional development.
- There are clues that something different is happening at WCU as a result of PT3 grant activities as faculty from three schools of the university join together. There are some definite hints that systems change is possible.
- Faculty began to feel part of a special cadre of tech-users, attending meetings that included displays of new technology integration and were often attended by not only faculty but by deans, the Provost and even the university president. Faculty members mention in their interviews that they received support not only from the FTC, or from their assigned "buddy" but also from colleagues who were available at the right time and place.

The USE-Tech program instilled new confidence in faculty participants to use technology which is captured in the following words of one member: "Before my work with USE-Tech, my understanding of technology was very limited - I didn't even know where to begin or what questions to ask. Now that I have gained some level of comfort with technology, I have a sense of what I need to know, and how I can use these new resources with my students."

Building the Capacity to Infuse Technology in K-6 Classrooms: A Training Model

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Abstract: A recent effort that enhanced university/K-12 school partnerships is Project PICT (Preservice Infusion of Computer Technology). This project, piloted in 1999-2000, and funded by the U.S. Department of Education, used a team approach to promote the infusion of technology in the teacher education and K-6 curricula. This paper will describe the Technology Training Model design, implementation and results collected from participants regarding their perceptions of the model. In addition, a lesson library of technology rich lesson plans, developed by K-6 teachers and preservice teacher teams, and artifacts will be shared. Findings from this pilot study determined the design of the Technology Training Model adopted for the three year Implementation Project, now underway.

Introduction

Teachers that are capable of preparing technology proficient students for the 21st century is notably one of the most critical needs in public schools today. This need has challenged teacher preparation programs to produce teachers that are able to infuse technology and curriculum. A recent response to this challenge is *Project PICT (Preservice Infusion of Computer Technology)*, a pilot project funded by the U.S. Department of Education, as part of the *Preparing Tomorrow's Teachers to Use Technology* Program. This project employed a team approach to assist the infusion of technology in the teacher education program at Bowling Green State University and K-6 curricula. The primary goal of *Project PICT* was to provide future teachers with the knowledge to utilize technology to enhance teaching and learning. To promote the realization of this goal, a *Technology Training Model* was developed which established a collaboration between teacher education faculty, arts and sciences faculty, K-6 teachers, and preservice teachers and was designed to facilitate the infusion of national and state (Ohio) technology standards for teachers.

The Model

The *Technology Training Model* was designed in keeping with research findings on effective technology training. Studies involving technology training (Dyrli & Kinnaman, 1994b; Munday, Windham, & Stamper, 1991; Sheingold, 1991; Siegel, 1995) report that the success or failure of technology integration is dependent on teacher training. This training should occur throughout the teacher prep program (Byrum and Cashman , 1993; Thompson, Schmidt, and Hadjiyianni, 1995), should establish a vision of how to use technology in the

classroom (Wetzel, 1993; Sprague, Kopfman & de Levante Dorsey, 1998) and should be an active process with participants being exposed to hands-on instruction that establish how to use technology as a resource for instruction (Roblyer and Edwards, 2000). Further, training should be in-depth, and should include on-going support (Bruner, 1992; Thompson, Hansen, & Reinhart, 1996).

Accordingly, participants were involved, for four months, in a variety of whole group sessions (Kickoff session, training sessions, support sessions) and project and team meetings. The Kickoff session established a vision of how to apply technology in classroom situations as area K-12 teachers presented a variety of strategies for using technology as a tool to enrich curriculum. Successful lesson ideas were presented and student products were available for examination. The Kickoff was followed by a series of in-depth hands-on training sessions featuring the application of the Internet and multimedia as tools to enhance learning in elementary curricula. Support sessions were scheduled throughout the four-month training period to provide on-going support to participants, enhance skill levels and build confidence in participants. Bi-monthly meetings of teams resulted in team and individual plans for technology infusion. These meetings served as an additional source of support for team members. Team plans included team goals, a description of how (lessons plans) each individual would integrate technology throughout the semester to meet these goals and how the subsequent lessons would be used to complement teacher education courses. Team plans are presently were implemented in teacher education classes and K-6 classrooms as a part of the *Technology Infusion Model.*

The Study

There were 28 educators that participated in this pilot study. Of these 28 participants, there were eight university faculty, ten elementary teachers, and ten pre-service elementary teachers. Focus group interviews were held at the end of the pilot study to reveal participant perceptions of the *Technology Training Model.* These interviews were audiotaped. The questions were related to project outcomes. The data was analyzed with the participants being offered the opportunity to review the transcripts. In addition, pre and post surveys were also administered to all participants (Vannatta & O'Bannon, 2000).

Findings

Results from the focus group interviews revealed that participants had very specific notions about the *Technology Training Model.* Participants reported that all sessions were beneficial but having technology using teachers share successful lessons and student products provided the inspiration and vision for infusion. Further, the use of K-12 teachers, as opposed to university faculty, as training facilitators was instrumental in making them believe that they could be successful. The support opportunities provided by project personnel and the teaming process was a critical component in the success of this project.

Conclusions

The primary goal of *Project PICT* was to provide future teachers with the knowledge to utilize technology to enhance teaching and learning. Outcomes revealed that the *Technology Training Model* developed and implemented in this pilot project facilitated this

goal. In addition, there continues to be an increase in the level of technology infusion in teacher education classes at Bowling Green State University and in two of the schools that serve as professional development schools for this teacher education program. Project success has resulted in an empowered teacher education faculty with a dedication to expose preservice teachers to teaching methods that use technology as a resource for instruction. The findings in this pilot study provided a foundation for the design of the 3 year *Project PICT Implementation* that is now underway. Access more about this project at http://www.bgsu.edu/colleges/edhd/LPS/EDFI/PICT/

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Coexistence of Technology and Healthy Active Lifestyles

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Computer use has significantly impacted the lifestyles of children, youth and adults in today's society. According to a major government report from the Centers for Disease Control and Prevention, the percentage of overweight children has doubled since 1980. The report warns of "...a new generation of young people who are in large part inactive, unfit and increasingly overweight." Much of the sedentary lifestyles are due to increase in computer usage and numerous technological advances that allow us to do more while moving less.

As physical education teacher educators we are faced with the dilemma of preparing teachers who will positively influence children to lead healthier more active lives and at the same time be able to infuse technology into their pedagogical practices. We must accommodate both of these issues by integrating technology in ways that substantively change the way pre-service teachers learn, so that we are not merely adding technology to an already full curriculum. The challenge is to create an environment in our teacher education program that allows for the coexistence of technology and healthy active lifestyles.

Our first step was to revise a traditionally taught fitness course, Lifetime Fitness, with a course focusing on healthy active lifestyle education (HALE). The intent of HALE is to: 1) Provide content that mirrors the situations in schools and communities. 2) Provide technological applications representative of resources available to preK-12 teachers. 3) And, infuse pedagogical strategies that reflect student centered learning practice. This curricular revision has taken considerably longer than we had first envisioned. First there were meetings and communications with PT3 group members, then selection and purchase of hardware and software, followed by hours of training and experimentation with set-up, application, and integration of hardware and software. We not only had to learn how to use the equipment and software, we had to design protocols for instruction. These protocols then had to be piloted with students to ensure viability in the instructional context.

Hardware included digital cameras, digital video camcorders, MAC iBooks@ connected to an AirPort@ base station, Qbe's@ (personal computing tablets), scanners, and recording devices that included portable CD-RW and Zip@ drives. Software included Dreamweaver@, Fireworks@, Flash@, Freehand@, and Adobe Photoshop@. Access to the wireless web, the availability of affordable digital video camcorders, and the portability and durability of this new hardware increased the feasibility of integrating this technology into a course occurring in a movement context. We have been able to capture teaching and learning episodes as they naturally occur in the complex environment of the gymnasium. The ability to construct instructional materials with such high ecological validity led us to focus on strategies emphasizing situated learning experiences.

We selected case method as our primary vehicle for educating students about HALE content and concepts. Physical education teacher education has traditionally used text-based-case-scenarios, however the digital video medium and other technological advances allowed us to enhance the case method. Certainly the value of the case method as a problem-based learning experience is well documented as it enables the learners to grapple with problems representing rich chunks of reality (Merseth, 1990). Never before has technology enabled teacher educators to so readily capture, manipulate and construct cases represented through digital media and publish them in user friendly, web-based environments. These learning experiences will allow pre-service teachers to examine the material outside of class at their own pace and reflect on the meaning of a healthy active lifestyle for themselves and their future students. Not only will students use case method to examine the material, they will be required to design and build their own cases and thereby learn to use this technology as a pedagogical application. Overall, HALE will allow physical education teacher educators to model technology integration and examine ways in which it can contribute instead of detract from the goal of a healthier, more physically active society.

[A digital video case demonstration will be used to illustrate the case method and related technology.]

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Working with Urban Schools Across the Digital Divide

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Abstract: This presentation addresses some of the issues which one university encountered when it collaborated with 3 disadvantaged urban schools as part of a PT3 project. Using a case study format, we detail many of the obstacles which were faced by this partnership including hardware availability & maintenance, wiring in older buildings, threatened teacher strikes and work slowdowns, changes in delivery schedules, prioritization of schools within the district for various types of support, and levels of approval needed for changes to take place. What the university ultimately needed to supply and how this partnership became part of a larger outreach to the schools and community helps to describe the special challenges faced when working on technology partnership issues in social environments of this type.

Large urban school systems present many technology infrastructure opportunities. Size alone makes them promising markets for telecommunications companies, and cable networks are often eager to supply low cost or free internet access to schools in exchange for rights to offer commercial services in that locale.

However, these same urban school systems can present many special challenges. This is particularly true when the "digital divide" is also a factor. This paper describes some of the issues which one university encountered when it collaborated with three disadvantaged urban schools as part of a Preparing Tomorrow's Teachers to Use Technology (PT3) project. The level of support which was required for the schools exceeded anticipations, and while the end product was satisfying, it was quite different from what had been envisioned.

Inner-city schools are among the most vulnerable to both the "access" and the "information underclass" problems which are key dimensions of the digital divide (National Center on Adult Literacy & International Literacy Institute, 1999). Each of these phenomena can also be observed in other settings (e.g. rural schools in isolated areas) but urban schools have their own manifestation.

Access can be considered in terms of *availability of internet services* (e.g. whether internet connectivity is available in classrooms or labs) or in terms of *quality of service* (e.g. are computers capable of sustaining access to the internet at sufficient speed). Although we were initially told that the schools with which we were working had internet access, we encountered access problems of both types. At one school, for example, wiring had been completed throughout the building almost a year before we entered, but due to contract disputes with the installer the drops had never been lit. In other cases, basic access was available, but the computers in the classrooms were either outdated or not maintained at a level where they could be reliably used for instructional purposes.

"Information underclass" (IU) is a term which refers to the widening gap between technology haves and have-nots. It is a complex phenomenon where problems in one area exacerbate related problems. For example, when an older school with an outdated electrical supply is put on hold for computer upgrades until the entire school can be re-wired, the technology gap between that school and others which have adequate wiring grows larger. When the teachers in that school which is not upgraded are not given inservice training and/or do not attempt to use computers as part of their instruction because of the older technology which was not upgraded, the gap is further amplified.

Several case studies illustrate many of the access and IU obstacles which were faced by this partnership between a university and three disadvantaged urban schools. Two examples of these cases are:

1) Hardware availability & maintenance - In at least two of the schools, teachers had an opportunity to participate in a local inservice model through which they would be given a new computer and printer for classroom use if they completed a technology project. However, in order to complete the project they had to access available computers in the building, many of which were old and prone to breakdown. Once they did complete the project and received the computer & printer, many were unable to connect to the internet, which made the computer primarily a local-use device which had minimal use by students. Local technology support personnel (in one case, teachers who contributed time after school) were unable to maintain all of the hardware, and replacement was not a priority.

2) Prioritization of schools within the district for various types of support - A district-wide program to upgrade the electrical supply in most of the schools did not include these schools because they were so old that the administration agreed that a separate contract would be needed. That contract was delayed for various reasons, and that delay had an impact on other technology which could be installed in the building.

Ultimately, a partnership was able to be formed between these schools and the PT3 grant which supported teachers and student teachers in these buildings. However, the extra time and equipment which had to be provided greatly exceeded the time and equipment provisions for other schools which participated in the project.

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InTime: A PT3 Catalyst Grant

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Abstract: The purpose of InTime (Integrating New Technologies Into the Methods of Education) is to provide the necessary resources for methods faculty to revise their courses, model technology integration, and require preservice teachers to integrate technology, along with components of quality education, in their lessons and units. This project is developing online video case studies to be utilized in methods courses that include videos of best practices showing scenarios from PreK-12 classrooms where teachers are integrating technology in a robust educational environment. The participants will have a chance o view and critique one of the online case studies of best practice in technology integration and quality education via video streaming. The issues addressed in this session will be interesting for deans, administrators, faculty, and decision –makers of all expertise levels.

Statement of the problem:
Reports from the National Council for Accreditation of Teacher Education (NCATE) and the Office of Technology Assessment (OTA) have called attention to existing deficiencies in teacher preparation programs in preparing preservice teachers to use technology effectively in the PreK-12 classrooms. Technology and the New Professional Teacher (NCATE, 1997) reports that preservice teachers should be required to apply technology in their courses and should see faculty model technology use in the classroom. In addition, Teachers and Technology: Making the connection (OTA, 1995) suggests that in teacher preparation programs where faculty model technology use, students will adopt the use of educational technology in their instruction. In order for undergraduate students to learn to use technology when they teach, it is vital that university teacher education faculty change the way they prepare teachers to use technology.

Literature Review:
According to conclusions drawn by the OTA, it is not enough to tell students about what is possible. "They must see technology used by their instructors, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these tools effectively in their own teaching" (OTA, 1995, p. 185). It is far more common, however, for education faculty to discuss technology, have students read about it, or demonstrate technology, rather than model it or require students to incorporate technology use into their lessons or units (OTA, 185). Also, NCATE (1997) identifies five reasons for the lack of technology integration in teacher education courses: 1) teacher education programs lack sufficient hardware and software; 2) education departments lack sufficient technical support; 3) teacher education faculty lack the knowledge, skills, and training that support technology integration in their teaching; 4) teacher education faculty are out of touch with what is happening in P-12 classrooms, including the rapid introduction of technology; and 5) the academic culture rewards and recognizes individuality among faculty, rather than valuing a common version about technology and incentives to seek professional development. Therefore, the goals of InTime project provide direct solutions to each of the above five barriers that prevent teacher education faculty from modeling appropriate integration of technology in their courses and requiring students to apply technology in their lessons and units.

Project Goals:
InTime (Integrating New Technologies Into the Methods of Education) is a $2,397,594 Catalyst Grant from the United States Department of Education. The Three-year InTime project addresses deficiencies in teacher education programs in preparing preservice teachers to use technology effectively in the PreK-12 classroom. The purpose of InTime is to provide the necessary resources for methods faculty to revise their courses, model technology integration, and require preservice teachers to integrate technology, along with components of quality education, in their lessons and units.

This project is intended to produce change in teacher education programs in three ways. First, the project will generate new learning resources on the web to support new teaching and learning processes in education methods courses. New learning resources will include development of video scenarios of PreK-12 teachers effectively integrating technology, along with components of quality education, in a variety of grade levels and content areas. These videos will be stored on a video server already in place at the university of Northern Iowa and made accessible online nation-wide. Second, methods faculty will revise their courses to model technology integration using the video scenarios and online discussion forum, require students to apply technology, and implement the Preservice Teacher Technology Competencies as exit criteria for their courses. Finally, methods faculty will share strategies for integrating technology and course revision with other faculty involved in the grant through Faculty Online Discussion Forum and nation-wide through print and web publications of their findings as well as presentations at national conferences.

Participant involvement and outcome:

1)The participants will understand the crucial part of the project, the "Technology as Facilitator of Quality Education Model" used in this project which shows that technology is not at odds with the core values of the American educational system. The model includes several major dimensions:

1. Students at the center of their own learning
2. Principles of good learning
3. Aspect of information processing
4. Standards from content disciplines, and
5. Tenets of effective citizenship in a democratic society
6. Teacher knowledge and behavior
7. Technology

The seven dimensions of the model provides a way for educators to view the integration of technology related tools into a robust educational environment and thus answer the hard questions regarding support for the shift in our educational activities toward technology. It sets up a framework for this robust educational environment and identifies key points at which technology should be implemented and evaluated to determine its impact. It simultaneously allows for the integration of new research findings into the appropriate segments of the model while maintaining the structure to evaluate the impact of technology tools on these new findings as part of an ongoing evaluation process. In so doing it allows a variety of stakeholders to see the complex process that is education and how technology is affecting the process.

2) The participants will view and critique online case studies of best practices in technology integration and quality education in a P-12 setting via video streaming technology. They will consider what content standards were addressed, how technology was integrated and which other components of quality education were present in the lesson.

3) The participants will discuss the project as well as share their ideas about its goals, applications, strengths and weaknesses.

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INTIME (Integrating New Technologies into the Methods of Education): A PT3 Catalyst Grant

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Purpose:

Reports from the National Council for Accreditation of Teacher Education (NCATE) and the Office of Technology Assessment (OTA) have called attention to existing deficiencies in teacher preparation programs in preparing preservice teachers to use technology effectively in the PreK-12 classrooms. Technology and the New Professional Teacher (NCATE, 1997) reports that preservice teachers should be required to apply technology in their courses and should see faculty model technology use in the classroom. In order for undergraduate students to learn to use technology when they teach, it is vital that university teacher education faculty change the way they prepare teachers to use technology.

Within this framework, the InTime (Integrating New Technologies Into the Methods of Education) project is developing online video case studies to be utilized in methods courses that include videos of best practices showing scenarios from PreK-12 classrooms where teachers are integrating technology in a robust educational environment. These video scenarios will help methods faculty and preservice teachers stray in touch with P-12 classrooms, thus breaking down time-worn distinctions between preservice and inservice teaching. This project will provide video scenarios from PreK-12 classrooms across the nation that will be made assessable to anyone at the project website. In addition, the methods faculty and students and PreK-12 teachers will utilize web-based instructional materials and an online discussion forum to foster reflective discussion about the methods of technology integration combined with best learning practices. Methods faculty will also revise their courses to include first-hand observations of technology integration in their partner PreK-12 classrooms.

Relationship to SITE 2001 Conference:

This project relates to SITE 2001 Conference because the online video case studies that will be available via video streaming from the project website feature best practices of PreK-12 teachers as they integrate technology in a robust educational environment. This environment, which is defined by the model, Technology as Facilitator of Quality Education (TFQE), currently being developed by the InTime project at the University of Northern Iowa. The model includes seven major dimensions:

1. Students at the center of their own learning;
2. Principles of good learning;
3. Aspect of information processing;
4. Standards from content disciplines, and
5. Tenets of effective citizenship in a democratic society.
6. Teacher knowledge and behavior
7. Technology

The seven dimensions of the model provides a way for educators to view the integration of technology related tools into a robust educational environment and thus answer the hard questions regarding support for the shift in our educational activities toward technology. It sets up a framework for this robust educational environment and identifies key points at which technology should be implemented and evaluated to determine its impact. It simultaneously allows for the integration of new research findings into the appropriate segments of the model while maintaining the structure to evaluate the impact of technology tools on these new findings as part of an ongoing evaluation process. In so doing it allows a variety of stakeholders to see the complex process that is education and how technology is affecting the process.

Abstract of Presentation:

InTime (Integrating New Technologies Into the Methods of Education) is a $2,397,594 Catalyst Grant from the United States Department of Education. The Three-year InTime project addresses deficiencies in teacher education programs in preparing preservice teachers to use technology effectively in the PreK-12 classroom. The purpose of InTime is to provide the necessary resources for methods faculty to revise their courses, model technology integration, and require preservice teachers to integrate technology, along with components of quality education, in their lessons and units.

This project is intended to produce change in teacher education programs in three ways. First, the project will generate new learning resources on the web to support new teaching and learning processes in education methods courses. New learning resources will include development of video scenarios of PreK-12 teachers effectively integrating technology, along with components of quality education, in a variety of grade levels and content areas. These videos will be stored on a video server already in place at the university of Northern Iowa and made accessible online nation-wide. Second, methods faculty will revise their courses to model technology integration using the video scenarios and online discussion forum, require students to apply technology, and implement the Preservice Teacher Technology Competencies as exit criteria for their courses. Finally, methods faculty will share strategies for integrating technology and course revision with other faculty involved in the grant through Faculty Online Discussion Forum and nation-wide through print and web publications of their findings as well as presentations at national conferences.

Participant Outcome:

Participants will understand the purpose of the Technology as Facilitator of Quality Education Model used in this project to illustrate that technology is not at odds with the core values of American educational system. This project will not just increase the use of technology but help teachers use technology to appropriately help children learn content, learn how to process information using technology, and practice the skills necessary to be a thinking citizen in a democracy. The participant s will be provided with an opportunity to experience online video applied on the educational environment.

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InTime (Integrating New Technologies Into the Methods of Education): A PT3 Catalyst Grant.

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Objective:

The objective of this session is to consider how to utilize online video case studies of PreK-12 teachers using technology in a robust educational environment in preparing tomorrow's teachers to use technology.

Short description of the presentation:

During the session the participants will experience an online video developed at the University of Northern Iowa applied on the educational environment. This video as well as 49 more videos is a product of InTime (Integrating New Technologies Into the Methods of Education) which is a $2,397, 594 Catalyst Grant from the United States Department of Education and which involves five Renaissance Group universities. The three-year InTime project addresses deficiencies in teacher education programs in preparing preservice teachers to use technology effectively in the PreK-12 classroom. The purpose of InTime is to provide the necessary resources for methods faculty to revise their courses, model technology integration, and require preservice teachers to integrate technology, along with components of quality education, in their lessons and units.

This project is intended to produce change in teacher education programs in three ways. First, the project will generate new learning resources on the web to support new teaching and learning processes in education methods courses. New learning resources will include development of video scenarios of PreK-12 teachers effectively integrating technology, along with components of quality education, in a variety of grade levels and content areas. These videos have being stored on a video server already in place at the University of Northern Iowa and made accessible online nation-wide. Second, methods faculty will revise their courses to model technology integration using the video scenarios and online discussion forum, require students to apply technology, and implement the Preservice Teacher Technology Competencies as exit criteria for their courses. Finally, methods faculty will share strategies for integrating technology and course revision with other faculty involved in the grant through Faculty Online Discussion Forum and nation-wide through print and web publications of their findings as well as presentations at national conferences.

The InTime project is developing the 50 best practice videos which will be available via video streaming on the project website http://www.intime.uni.edu Every video has seven audio tracks, first of which is the live classroom audio. Also, each video is analyzed in six additional versions which will contain narratives about how the teacher is demonstrating one of the six elements from the technology as Facilitator of Quality Education Model (TFQM). Elements of quality education from UNI's Technology as Facilitator of Quality Education Model include

1. exemplary technology;
2. democracy in the classroom;
3. rich content;
4. information processing;
5. effective principles of learning;
6. exemplary teacher knowledge and behaviors.

The above listed elements of quality education provide a way for educators to view the integration of technology related tools into robust educational environment and thus answer the hard questions regarding support for the shift in educational activities toward technology.

The edited videos of approximately 5 minutes in length are searchable at the project website not only by the elements of quality education but also by grade level, content area, teacher's name, state, video tittle, and video code. In addition, these videos will be also available on CD-ROM and DVD.

During the session, the participants will have a chance to view one of the videos and its seven versions. Each of the seven audio tracks will appear on the left side of the screen with a written teacher's narration running at the bottom of the screen. On the right side of the screen, the participants will see the full description of the classroom practice. This description includes the teacher's name and the school location, grade and curriculum area. Further, they will see the detailed unit description which covers necessary preparations and procedures. Next, all necessary information about this classroom practice, such as tools and resources, assessment, timeline and course outline as well as the teacher's personal comments on the implementation of this particular activity will appear on the right side of the screen.

Participant Involvement and Outcomes:

So, the participants will understand the purpose of the "Technology as Facilitator of Quality Education Model" as well as view and critique online case study of best practice in technology integration and quality education in a PreK-12 setting via video streaming technology. They will consider what content standards were addressed, how technology was integrated and which other components of quality education were present in the lesson.

ABSTRACT:
The objective of this session is to consider how to utilize online video case studies of PreK-12 teachers using technology in a robust educational environment in preparing tomorrow's teachers to use technology. The participants will have a chance to view and critique one of the online case studies of best practice in technology integration and quality education in a PreK-12 setting, developed at the University of Northern Iowa, via video streaming technology. They will consider what content standards were addressed, how technology was integrated and which other components of quality education were present in the lesson. The issues addressed in this session will be interesting to deans, administrators, faculty, and decision-makers of all expertise levels.

Putting the Pieces Together: Systemic Change for Technology Integration in Teacher Education

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Abstract: Today's schools must prepare students to use computer-related technologies well in a range of tasks. For K12 schools to prepare their students, colleges and universities must prepare teachers to integrate technologies well for learning. Thus, reform in teacher preparation must become a high priority. Research has shown that lasting reform must be systemic—in other words, the parts of an educational system must synergistically support one another. In efforts to reform teacher education at an urban public university, we have tried to ensure that policy, curriculum, field experiences, and faculty teaching practices all support the meaningful integration of technology. Our efforts to sustain systemic change along these lines have been greatly enhanced by a "technology and learning center" and a Preparing Tomorrow's Teachers to Use Technology grant. We show through a case study and vignette how these pieces fit together for reform towards the integration of technology in teacher preparation.

Introduction

The Need for Technology-Using Teachers

Today's workplaces are increasingly computerized and networked; hence, schools must better prepare students to use these technologies flexibly and creatively in their lives, for tasks ranging from problem solving to information gathering to communication (SCANS, 1991). In order for K12 schools to prepare their students, colleges and universities must prepare teachers to integrate technologies well for learning. But colleges, schools and departments of education have lagged to date in their integration of technologies for learning into teacher preparation. Thus, reform in teacher preparation must become a high priority if real change is to take place in schools (Darling-Hammond, 1993).

Historical and Theoretical Background: Change Studies

Research on educational change has shown that lasting reform must be *systemic* (e.g., Brown, 1992; Fullan & Miles, 1992). In other words, the various parts of an educational system must synergistically support one another. A sociocultural (Wertsch, 1998) perspective on human action provides some guidance as to how to explain and plan for systemic change. Wertsch shows how the multifaceted, interrelated aspects of human activity in complex social settings can be captured using Kenneth Burke's "pentad": the act, scene, agents, agency (or cultural tools), and purpose. The meaning of an *act* is simultaneously constituted by the *scene* or location in which the act occurs, the knowledge, role, and personal history of the *agents* involved, the properties of the *cultural tools* or mediational means used to accomplish the act, and the *purposes* which the act served. In our reform, we are making an effort to change the "scene" at the College of Education to include use of technology as a cultural tool for teaching as a normal matter of course. The relevant agents in our case have been the dean and faculty members, supported by staff working on a Preparing Tomorrow's Teachers to Use Technology (PT3) grant. The scene began changing with policy and curriculum changes and the opening of a state of the art "technology and learning center." Through a curriculum reform, the teacher preparation activities supported by faculty in their courses have been reexamined to more adequately integrate technology while simultaneously serving the many other purposes of individual courses. In this paper, we explicate how we have put these pieces together for systemic reform towards the integration of technology in teacher preparation.

Background at the College of Education

The College of Education at the University of Missouri-St. Louis prepares a large number of teachers for K12 schools in our region. Prior to 1995, technology was not an integral aspect of the college's life. Although all faculty had computers in their offices and a few Educational Technology courses had been offered for years, few faculty members used technology for their instructional work. For instance, approximately 2% of our faculty was using email and online discussion groups with their students, and about that same percent referred their students to web resources and taught using technology. There was neither a technology course requirement nor an expectation of teacher education students demonstrating technology integration competency prior to certification.

A New Dean and a New Teacher Preparation Curriculum

With the entry of a new Dean and statewide certification changes in the second half of the 1990s, the situation changed. Paper copies of "The Dean's Weekly Update" were banished upon the dean's arrival in 1996—faculty members who did not use email before his appointment were forced to begin using it soon after. Innovations and grants involving technology were encouraged. A "futures" planning process resulted in a college-wide commitment to the importance of technology to the preparation of new teachers for the 21st century, and in a redesigned curriculum that required both a larger field component and technology integration in courses at all three "levels" (Level 1: Exploration, followed by Level 2: Analysis and Level 3: Professional). And finally, the state of Missouri instituted new performance-based (rather than course credit-hour based) standards for teacher certification, which included the need for all new teachers to demonstrate competence at integrating technology.

The Final Pieces: PT3 and the TLC

Our dean and development officer also envisioned and secured funding for a Technology and Learning Center (TLC) for our College and an Endowed Professorship of Technology and Learning. In the Winter of 1999, the Endowed professor and another full-time faculty member (the first author) were hired, and plans for the building of the TLC began in earnest.

At the same time, a group (headed by the second author) who had worked on technology integration with teachers in local K12 schools (the MINTs—Multimedia Interactive Networked Technologies—Project) submitted a grant proposal to the U.S. Department of Education's PT3 program. We proposed adapting the professional development practices utilized in MINTs to support change towards technology integration in active teaching and learning projects among cadres of university faculty, and using the MINTs classrooms as fertile sites for future teachers' field experiences.

During the Fall of 1999, the PT3 grant was awarded and the TLC plans were also finalized. The TLC was planned as a "hothouse" for educational technology, to mirror and model the possibilities for technology integration in K12 schools. It includes work clusters, a model classroom space, a seminar room with interactive whiteboard, and a "cyberlounge" with wireless networking (see Figure 1). The reconfigurable work clusters are set up to allow for solo work or collaboration on projects involving the Internet, standard office suites, and multimedia technologies including graphics and digital video. The classroom space is meant to allow discussion without computers between people as well as computer workstations and tables for discussion or work offline.

The pieces had all come together for the Winter semester of 2000:

- policy at the state and college level that encouraged technology integration,
- a new curriculum that allowed for introduction of new activities and tools in courses,
- requirements for field experiences as well as sites that integrate technology well,
- a PT3 grant to support university faculty in changing their teaching to incorporate technology, and
- a technology and learning center with staff and infrastructure to support technology integration

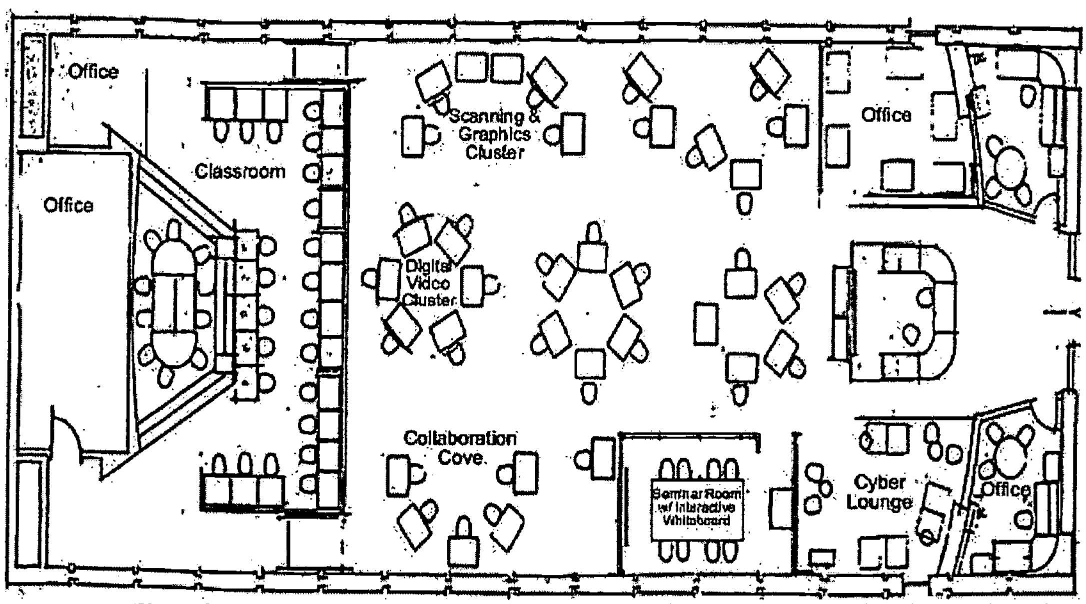

Figure 1: Floor Plan of the E. Desmond Lee Technology & Learning Center at the University of Missouri-St. Louis College of Education.

Case Study: Introduction to Learners and Learning Course

The new undergraduate teacher preparation curriculum at UM-St. Louis consists of three levels, the first of which is Exploration. At this level, there are three courses: Introduction to American Schools, Introduction to Teaching, and Introduction to Learners and Learning. In order to illustrate how the pieces of our reform efforts fit together, we describe the technology component of the latter course as implemented in the Winter 2000 semester.

The fourth author instructed this course, and groups of her students developed web sites about child development topics of their choice. The primary goal for the project was learning about psychological development, but secondary goals included gaining an appreciation of the range of resources available on the World Wide Web, learning how to find those resources, and beginning to learn how to make web resource pages (which we expect technology-using teachers at the K12 level to utilize to support learning activities in the classroom). The construction of a set of resource web pages about development, with

synthesis and annotated links to related sites on the Internet, was an ambitious project for an introductory education class, and many students began the process with considerable trepidation. As one student stated, "learning how to create a web page was very stressful to even think about" at the beginning. Student reactions to the technology were somewhat related to their level of experience with technology, with beginners feeling more overwhelmed at the beginning despite recognizing the relevance of technology skills for classroom applications.

In order to support the preservice teachers in the achievement of this complex, ambitious project, a variety of supports were utilized. During class meetings held in a computer classroom, two PT3 staff acted as guest facilitators along with the instructor. The PT3 staff introduced the class to web page editing basics using Netscape Composer (a free web page editor included with Netscape Communicator), and distributed a handout describing the basics. Using a web page template on disk, the facilitators assisted the groups in adding and modifying text, a digital photo of themselves, and links to resources on the Internet. Several classes were devoted to completing the assignment. The computer expertise and comfort in the class varied widely, from a couple with extensive experience including web page editing, to quite a few with word processing, email, and web browsing, to several with little experience and a good deal of fear. The instructor created groups of three or four students and made an effort to place at least one student with stronger technology expertise as measured by a skills survey administered online with a system called Profiler (http://profiler.scrtec.org). The in-class orientation and the handouts proved to be scaffolds of some use to the students, but more in-depth background and detailed written reference materials were desired by many. Not surprisingly, the people provided the most effective scaffolding: the multiple facilitators during class meetings provided by PT3 helped, as did the more expert peers spread among the groups. Nonetheless, many students wished for more in-class time with facilitators, and some lamented the difficulties of groups meeting outside class at a largely commuter university.

Several students wished for more staff support in the computer labs between classes. Frustration at the lack of support at the drop-in labs is notable, because at the time the assignment began, the College's Technology and Learning Center had not opened (it opened mid-way during the semester).The staffing model of the traditional "computer labs" on our campus probably reflects the norm on most campuses—staff are hired mainly to control access into and out of the area and maintain the equipment. The staffing level is typically one "monitor" per lab. In contrast, the TLC's mission is explicitly to support the educators—and all are future or current educators—who use the facility in their use and learning of technology for education. In addition to the scheduled workshops we offer to students and faculty, our staff "on the floor" offer as much assistance and guidance as they can give to our customers, although on-the-spot, extended individual tutorial sessions are not practically feasible with our large numbers of users (hundreds per month in the spring of 2000, thousands in the fall). We have worked hard to cultivate an atmosphere in which our customers feel free to ask questions and seek assistance. This is facilitated by having two staff on duty at most times we are open.

In reflection papers submitted after the assignment was complete, most students expressed agreement with the notion that teachers should be prepared to integrate technology. As one student said, "I believe it is very important for our class as college students and also as future teachers to be aware of and comfortable with the technology available." But some expressed frustration at a technology assignment they did not expect in a psychology of learning class. This frustration may have been exacerbated by the fact that some sections of the introductory class during this period were not being offered in the new curriculum model, and thus did not include the technology work—therefore, students were aware that some of their peers were not required to complete the difficult work involved in a web site. As the new curriculum is more fully implemented, students who do not use technology in their courses will be more the exception than the rule.

Despite the frustrations, most students were pleased with their accomplishments. As one put it, "while I did have a hard time working on this website, ... I did learn a lot about the Internet, computing skills, and all the support websites that are available."

In the Fall 2000 semester, the developmental web site project was repeated and extended to three sections of the new curriculum course, two of which are taught by part-time instructors. Most of the class meetings on technology were scheduled in the TLC classroom space, and facilitators were once again available for those meetings. Students during this second round had very similar reactions to the project as those in the second round—a mixture of excitement at using technology which is recognized as important for education and some trepidation at the newness and complexity of the task. Students have made more

considerable use of staff support in the TLC after spending time in the space with their class, and in reflection papers, no requests for additional supportive staff were made.

Vignette: Technology Overcomes Achilles

A vignette from early in the Fall 2000 semester serves as an example of the promise of readily available information technology settings such as the TLC as learning resources. One of the instructors involved in PT3, who we will call Ann, injured her Achilles tendon before the second class meeting of the semester, and was consequently unable to attend her Introduction to Instructional Methods class. On the day of class, Ann called up the PT3 project director, Ms. Mastin, and asked her to take over the class for the day by leading the group in an assignment Ann had prepared. Ms. Mastin asked the faculty member if they were using the new university online course material system, a version of CourseInfo's Blackboard. The system had just been installed on campus in the summer, and many of the instructors and students, including Ann and her class, had not yet had training or experience using it. Ms. Mastin suggested they give it a try anyway. With Ms. Mastin's help over the phone, Ann posted an announcement for her students, and posted the assignment document in the area reserved for that. Ms. Mastin met Ann's class and took them to the TLC to read and work on the assignment. The class completed the assignment in the TLC, with Ms. Mastin acting as the facilitator, and also with the support of discussions with their neighbors about both technology and content.

The TLC and the technology infrastructure facilitated this successful adjustment of a class meeting in several important ways. Ms. Mastin's availability to advise Ann on the capabilities of technology to enable work on the assignment was essential. The relative ease of posting announcements and assignment documents on the Blackboard system was also key—if Ann had wanted to post her ideas to a standard web site and had not yet attended a training session, she would have been unlikely to succeed in a timely enough fashion for class that very evening. And finally, the availability of a space in the TLC for individual class meetings to work with staff facilitation, a projector for display and walk-through of technologies for first-timers, and a classroom space that allowed for students comfortably working with one another all created new possibilities for successful technology integration into university coursework.

Next Steps

At this point in the implementation of our reform, we are expanding our scope in multiple ways. The new curriculum is being phased in at the same time new groups of faculty are being supported in technology integration. In the Winter of 2000, one section of the three Level 1 courses was offered. In the Fall of 2000, three sections of each Level 1 course is being offered, and one section of each new Level 2 course. In the Winter of 2001, Levels 1 and 2 will be offered in more sections, and new Level 3 courses will be offered. At the same time more introductory level courses are being offered in more sections, we are recruiting faculty members to participate in PT3 professional development activities in order to get extra support in integrating technology, and make use of the Technology and Learning Center. In addition, we are attempting to build in sensible articulation of technology competencies across courses and levels of the curriculum, but we have a great deal of progress yet to make. The change over the past year has been tremendous, however.

Conclusion

Researchers have demonstrated that the adoption of symbolic aspects of reforms such as trendy descriptors ("multiple intelligences", "brain-based instruction") or new textbooks can prove more symbolic than substantive (Ball, 1990; Fullan & Miles, 1992). At the University of Missouri-St. Louis College of Education, we have attempted to provide a whole new "scene" (Wertsch, 1998) where university instructors and students preparing to be teachers try out new ways of acting. Maybe this exciting new play they are constructing will have a longer run on the educational scene than other reforms.

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Rethinking Teaching and Learning in the Age of the Virtual-Classroom

"**Abstract:**" The objective of this paper is to address the question of the changing conception of knowledge at present and the need for institutions of higher learning and educators to reconceptualize the notion of knowledge and learning in order to keep in line with the changes in the society. Furthermore, I will argue that it is necessary to develop teaching methodology that can function effectively in the new technologically-grounded paradigm that is evolving in the realm of the social and the economical on a global scale today. This paper is based on my experience in developing, designing and delivering a web-based Spanish Civilization course at the University of Arizona, Tucson.

Learning Environment

The Spanish Culture and Civilization course, Spanish 430 was taught during Summer Session I, 2000 at the University of Arizona, Tucson. It was unique in that it gave students the freedom to access class resources at any time, from any internet-connected computer in the world. Indeed, while many students in the Tucson area used the Web to read class materials, many others took part in class discussions and completed their assignments from Phoenix, Flagstaff, and Nogales, Arizona, San Diego and Los Angeles, California, and even from as far away as Spain and Italy.

The course lessons were divided into three broad categories: *La Tierra* y *El Pueblo*, *Poetas*, and *Pintores* (The Land and People, Poets, and Painters, respectively). Each of these categories was divided into subsections where class readings, practice quizzes, and discussion topics could be found. All class readings included images, photos, maps, audio and video materials along with text, and a dictionary feature that instantaneously provided word definitions at the click of a mouse.

One of the most innovative features of the course was a collaborative project. Students were required to form groups of three and read Spanish newspapers during the five-week period of the class, paying close attention to a particular news story and the manner it was presented in the Spanish news media. At the end of the course the groups presented their observations in the form of essays.

Student participation was facilitated principally through a section of the course called *Mesa_Redonda*, but also through available chat rooms and e-mail. *Mesa Redonda* was a virtual round table where students were required to both post their thoughts on class lessons and read the postings of their classmates. During the five weeks of this course, there were over 500 postings. Students also had the option to use chat rooms to ask specific questions about class materials during the professor's virtual office hours, or were able to have their technical questions addressed by the Technology Preceptor of the course. Chat rooms also provided for students who were in different areas of the world a means by which class readings and projects could be discussed in real-time. Students also made use of both the class e-mail system and their own e-mail accounts to discuss class topics and have their questions answered.

The designing, developing and delivering this experimental course presented me with several challenges and made me think about teaching and learning in the age of technology.

Technology and teaching

Technological innovation, the demands of global economy and the drive towards a cost-effective education are forcing educators, administrators and students alike to incorporate new and innovative technologies into education. Consequently, the virtual-classroom has emerged as an alternative to the traditional classroom as well as conventional distance learning courses. However, the virtual-classroom is yet to realize its full potential. Teaching and learning in a virtual-classroom cannot be conceived as a simple enhancement of the delivery of customary text-based materials, nor should it be thought only as freedom on the part of learners to access materials outside the confines of physical classroom and text. Technologically-oriented education in its present state continues to rely on traditional pedagogy. This approach will be unable to cope with the new paradigm that is redefining the society in hitherto unknown ways. The challenge for educators is to evolve new methodologies wherein the concept of teaching and learning has to be thought anew.

Knowledge in Information Age

The technological innovations and societal changes over the last fifty years have profoundly transformed the concept and utility of knowledge. Jean-François Lyotard in his book *The Postmodern Condition: A Report on Knowledge* characterizes knowledge in the postindustrial age as "payment knowledge" and "investment knowledge" (Lyotard, 1984, p. 6). While the "payment knowledge" is "units of knowledge exchanged in daily maintenance" the "investment knowledge" is "dedicated to optimizing the performance of a project" (Lyotard, 1984, p. 6). However the educational institutions-unaffected by changes in half a century—conceive knowledge as an end in itself. The academics envision the universities as places for pursuing whole body of human knowledge, therefore "research and the spread of learning are not justified by invoking a principle of usefulness" (Lyotard, 1984, p. 34). These two forms of conceptualizing knowledge today are the undercurrent of conflict witnessed between the communities and legislatures who demand greater accountability from academics on the one hand, and the universities that defend their freedom on the other. Wedding Internet technology and education as solution for this conflict is a losing preposition because these two groups views of knowledge are radically different. The possible resolution lies in institutions of higher learning reconceptualizing their idea of knowledge and its pursuit.

Teaching in classroom

Teaching in a traditional classroom takes place in a narrative framework: sender, receiver and referent. The teacher is the sender who stands before a class and transmits information during sixty minutes. The receivers are students who patiently wait for sixty minutes to pass, and the textbook, a bound volume of knowledge, is the referent. This narrative model does not have an inbuilt mechanism to foster teacher creativity and learner involvement. They are left largely to the personal initiative of senders and receivers. The anecdotal experience of most of those who went through colleges and universities demonstrates that they have had one or two teachers who inspired them to learn and one or two courses where they really learned.

The dissonance teachers experience between teaching and learning in the classroom is the reflection of the conflict between the two notions of knowledge I referred to earlier. The student body that enters academia is drawn from a society affected by the technological changes. They are exposed to a different form of information mapping and they process that information in a different way. Television and videogames, major sources of information and interaction, are episodic in nature, task-oriented and use-determined. However the narrative models of teaching and learning ensue an accumulation of large body of knowledge whose goals and utility may or may not be realized at a later date.

Challenges of a virtual-classroom

The Internet, so far, is the maximum achievement of the technological revolution. If web technologies are to be used in education, the concept of knowledge, how it is presented and for what purposes it is used has to be rethought. Without this reconceptualization of knowledge, publishing lessons and class notes on web with few added features such as note taking, search and visuals will be a mere translation of narrative model to Internet. Using the web as a delivery mechanism of traditional classes will be counterproductive because research has shown that students have not taken to reading on screens. Moreover, web learning eliminates the many benefits of live interaction in a classroom.

In a fixed classroom an innovative teacher responds immediately to evolving dynamics of the course through interaction with students and by evaluating students' responses to the material and teaching style. However in the web-delivery such spontaneity is missing. The course cannot be redesigned or reoriented at such short notice. One potential solution is to incorporate as many scenarios as possible into course design and use the multimedia interactions. The teacher in a virtual-classroom has to forgo his or her role as transmitter of knowledge and become facilitator of learning. For this to occur the students have to be trained to play a new role, that is of active learner instead of passive listeners. My experience has taught me that both, the role of teacher and student have to be rethought and reengineered in adopting technology in education and creating virtual-classrooms.

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Developing Techno-Savvy English Language Arts Teachers: from Blank Screens to Full Directories

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Abstract: This paper discusses the ongoing process of infusing technology into an English language arts teacher preparation program and includes an update of a longitudinal case study of a cohort of undergraduate students' development as teachers, learners, and users of technology and English language arts pedagogy. Principles and practices used to determine the degree and process of infusion are discussed in connection with teaching, learning, and technology strategies used by the methods professor and the preservice teachers. Also included are the perspectives of an instructional technologist specialist who works with the program, a middle school teacher, and the student teacher supervisor.

Introduction

The Middle Grades English language arts teacher education program at NC State University has in recent years committed to infusing technology in a seamless, constructivist way that simultaneously supports the building of students' confidence and competence as teachers, learners, and technology users. By merging the NC Technology Competencies for preservice teachers into the curriculum, the faculty and students have learned together the value of balancing and interweaving content, context, and technology. This process was catalyzed in 1999 by the reception of a PT3 grant from the US Department of Education. Through the grant the English language arts faculty received both technical and instructional assistance in boosting the degree of technology infusion in content methods courses.

Background

As a way to assure the infusion of technology into the program, faculty from English education and instructional technology created MIDtech, a web site specifically designed for preservice students in the middle grades program (http://www2.ncsu.edu/midtech/). The web site, developed with continuous feedback and evaluation by students in the program, contains interviews with middle school educators who infuse technology into their teaching in a thoughtful, successful way as well as numerous other useful resources. From the site NC State students, soon to become teachers, can locate exemplary lesson plans written by teachers, materials they can use in teaching, tutorials for technology use, and links to other courses and student work. They can also find the North Carolina required competencies for teachers (http://www.dpi.state.nc.us/tap/assess.htm#BASIC) as well as the matrix which shows how these competencies have been infused into the curriculum and courses for their program at NC State (http://www2.ncsu.edu/midtech/resources/preservice/msltables/matrix1.html).

Planning and Principles

The English language arts middle grades students take several pedagogical content courses that provide opportunities for technology infusion. Three classes which assume much of the technology infusion responsibility are ECI 307 Teaching Writing Across the Curriculum, ECI 430 Methods and Materials for Teaching Language Arts in Middle School, and ECI 454 Student Teaching in Language Arts. It is from these courses that the following examples were drawn.

Beginning in January 2000, we [the English language arts methods professor (Carol), with the assistance of an instructional technology specialist/graduate assistant (Judy) as well as the university supervisor (Amelia), and a middle school teacher/graduate student (Julie)], set as a goal the seamless infusion of technology into the Teaching Writing course. Carol was concerned about keeping content pedagogy, not technology, as the touchstone for the class; Judy was anxious to be of assistance and to bring her technology knowledge and skills to the planning; Julie was interested in connecting the preservice students with her middle school students to improve their writing; and Amelia referenced the state of technology in the area middle schools where these students would be student teaching.

Initial brainstorming and creation of the syllabus provided the jump-start for an active, challenging semester. Within the first week of class, Carol collected from the students a self-evaluation narrative of their computer competency, confidence, and present use. The students reported that they used computers primarily for writing papers (word processing), emailing, and searching the Internet. One student reported her ability to use PowerPoint for presentations while another reported using her computer for playing games. All of the students said they were comfortable when they knew the computer and the software but had little confidence in themselves as "experts" who could use technology in teaching. In short, they were blank screens about the infusion of technology into their teaching of English language arts.

In the months preceding the beginning of class, Carol had been working independently to add computer technology to her teacher preparation classes. Her refusal to make the technology just an "add-on" to the program and courses set into motion her struggles about the best ways to both use and infuse technology. Frequently Carol refers to content-specific methods instruction as a double helix--i.e., teacher educators are not just teaching the content but also the content pedagogy; adding technology to that duality created another element to an already complex challenge. Driven by that challenge, Carol worked with Jeffrey Golub at the University of South Florida to develop an article entitled "Preparing Tomorrow's English Language Arts Today: Principles and Practices for Infusing Technology" (Pope & Golub, 2000) published in the new on-line journal, *Contemporary Issues in Technology and Teacher Education* (http://ww.citejournal.org). The purpose of this article, like the other content-specific articles in the first issue of the CITE Journal, is to stimulate a national conversation about the principles and the viability of their use in preparing English language arts teachers.

The following principles from that article guided the infusion of computer technology into English language arts pedagogy courses: 1) introduce and infuse technology in context; 2) focus on the importance of technology as a literacy tool; 3) model English language arts learning and teaching while infusing technology; 4) evaluate critically when and how to use technology in English language arts classroom; 5) provide a wide range of opportunities to use technology; 6) examine and determine ways of analyzing, evaluating, and grading English language arts technology projects; 7) emphasize issues of equity and diversity.

Place and Practice

Using the principles as guidelines for pedagogical decisions, Carol and Judy worked together and independently to explore ways of naturally infusing technology into the Teaching Writing class and then again in the Fall 2000 methods class--the two university-based English language arts pedagogy courses that precede student teaching. The Teaching Writing class was held in the computer lab so that Carol and the students had easy access to technology. By being in the room with the technology, Carol thought she would be much more likely to use the available technology for teachable moments that grew from the class interests and to have the technology waiting to be used. This decision proved to be a wise

one. At the end of the semester when we calculated the number of hours of technology use in the class, we discovered that over 50% of the class time had been spent using technology in the class context.

One of the most valuable technology infusion lesson cycles Carol used in the Teaching Writing class was the one in which she and Julie connected their students via technology. This E-PALS Project was one which Julie and Carol had tried before with limited success. This time they knew both the technological and communication hurdles they faced and were able to eliminate most of those problems. Carol's students were matched one-to-one with Julie's middle school students. The goal of the E-PALS project were that 1) the middle school students would get special attention from a university student to help them with their writing; 2) the university students would learn, through practice and guidance from Carol, how to respond to students' writing and guide their revision to a final product. This process is discussed and outlined on an NC State web site (http://www2.ncsu.edu/ncsu/cep/ci/eci307.html).

The E-PALS Project addressed all of the principles for infusing technology into teacher preparation. The preservice teachers were using technology to learn how to respond and guide middle school students' revision, and they experienced the impact of language choice, audience, and voice when the "teacher" was communicating completely on-line. Because class time was spent on guiding the preservice teachers' responses and guidance to the middle school students, the university students critically evaluated what was being lost and gained by e-communication as opposed to the face-to-face interaction they had with each other in the classroom. Questions regarding how to evaluate and how to grade technology products constantly emerged without Carol's designating a "block" of time to consider grading and evaluating. As they worked with their E-PALS over several weeks, the preservice teachers had numerous questions about issues of equity and diversity--e.g., how to provide more-than-equal time to students who do not have access to computers at home and how to write grants to get more computers in classrooms for all students. They also experienced how to keep information in e-folders in the classroom and how to open each student's file from the local server.

Most importantly, the students built relationships with middle school students via email. They learned both how to communicate openly with their own students and how to guide students' writing; they learned how to revise and guide revision; they learned not to make assumptions about students unnecessarily; and they built their confidence as teachers. When Carol's students went to Julie's classroom across town at the end of the semester, the students immediately began talking and establishing the same bond in person that they had established through cyberspace. Both groups of students benefited greatly from this interaction.

More Applications - Teaching Writing

Following are a number of other ways in which Carol, with Judy's assistance, infused technology into her Teaching Writing and Methods classes.

Class Web Site:	The web site is an in-process location that changes as the class evolves. It is dynamic and reflects the class movement itself. Teachable moments become web links, and student work contributes to the site.
Class Notes:	Each week one student keeps the class notes, which are posted by the students on the web site for both downloading and keeping a record of the class.
Daily Writings:	Student have opportunities to write daily in the Teaching Writing class. They have a choice of writing on computers or by hand. Students often choose differently, depending on the day, as does Carol.
Response/Chats:	Students respond to each other's writing, ideas, questions, and views via email, Netforums, real-time chat formats, face-to-face, on e-cakewalks (by moving from computer to computer and responding), and by opening documents within their own and their peers' e-files.
Server:	One of the ways in which students get practice in how they can store and retrieve both their own and their future students' work is to set up

and experience the use of a class folder and their own folders. From these folders (which are analogs to tangible class writing folders), students pull up assignments placed in e-folders by Carol and get a chance to post information in their peers' folders.

In addition to these larger activities, students also experience and reflect on the usefulness and application of such strategies as using split-screen response and/or note-taking/note-making, searching the Internet and taking notes on a word processing screen, doing "invisible writing" to break habits that block writing fluency (Strickland, 1997), evaluating and critiquing web sites in writing (then sharing their written results with their peers), and participating in videoconferences with other universities.

The critical element in the infusion of these technology activities in the Teaching Writing class is that before, during, and after the experiences, Carol and the students reflected on the value of the activity. Then they considered various ways of applying those activities in a real middle school classroom. Why, according to what we know from English language arts pedagogy research and informed theory, would these experiences benefit the learning of the middle school students? What would they gain from using computer rather than paper and pencil technology? How could the experiences be modified if the classroom had only one computer? three computers? no computers, but a computer lab down the hall? The incorporation of reflexive thinking assured that the preservice teachers were not only answering the "What" question but also considering the "So What" and "Now What" questions.

Building on Experiences

When the students from the Teaching Writing Across the Curriculum class entered the Methods class this fall, Carol and Judy sought to build on the students' skills and also stretch them a bit. However, the class was not scheduled in the computer lab. Instead, Carol, Judy, and the students used a mobile classroom cart which included wireless computers complete with Internet access via airports, a teacher computer with display capability, and a portable printer. The students quickly learned to set up the cart, hook up the Internet access, use both the MACs and PCs, and use the demonstration computer. They also determined how best to set up the classroom so that every student could participate and see both the front and back of the classroom, dual foci for projection and discussion. Even though students had valuable experience with this equipment and quickly made connections about how such wireless technology could be a tremendous advantages in schools, neither they nor Carol used the computers as readily as they did in the computer lab where there was no danger of batteries being dead or other quirks being encountered. Although that class has not yet ended, we project that Carol and the methods students will use the technology in class much less often than they did in the Teaching Writing class.

Besides using computer technology to critique web sites, do research on the Internet, and view various software programs, Carol and the students embarked this semester on a project to develop lesson plans appropriate for teaching Mark Twain's *The Adventures of Tom Sawyer* to middle school students. After reading the novel and perusing web sites, the class visited Stephen Railton, an English professor at the University of Virginia who has created a series of digital archives that he uses in teaching his university classes on Twain. The preservice teachers visited his class on the day they were discussing *Tom Sawyer*; they observed and participated in the class. Students are now creating lesson plans for teaching *Tom Sawyer* with middle school students by using the digital archives (http://etext.virginia.edu/railton/tomsawye/tomhompg.html).

These lessons, along with the preservice teachers' work from this semester, will be posted on web sites they are currently developing as part of their teaching and technology portfolios. The web sites will include an introduction, various types of lesson plans, student teaching unit plans, a teaching philosophy, and lessons which include technology infusion. [Although these web sites are not currently posted, web sites from former Methods students can be found at http://www2.ncsu.edu/classes/eci430001.]

Student Teaching and Beyond

Besides continuing to support and guide preservice teachers' infusion of technology in their exemplary English language arts teaching, we want the students to use materials from their own web sites in their student teaching and with their cooperating teachers. However, from our work in schools in our areas, we know the challenges our preservice teachers will be facing as they attempt to infuse technology seamlessly into their teaching. Many schools have computer labs halls away from the content classrooms, and often these labs are reserved for "computer classes" (keyed to the eighth grade computer competency test). This phenomenon was validated when the students went into area middle schools to determine what computer technology exists and what is actively used. By and large, students found few computers in classrooms and even fewer teachers using the computers in their own teaching. Rather, they found computer labs that had to be reserved far in advance and teachers who used technology at home but not as an active part of their teaching.

Amelia's observations and studies of area middle schools confirm that schools face challenges of equipment shortages, outdated or malfunctioning equipment, and often only one computer lab for a thousand students. She also reports that, although there are often highly committed technology resource teachers in the schools, they cannot take care of all the demands for both their time and the equipment. Teachers face the greatest challenge in that they have little time to learn and then figure out ways to use technology in their own teaching.

Student teachers who, as a result of the increased infusion of technology into content methods courses, view technology as a positive teaching tool and are ready to use technology in their teaching. If their cooperating teachers use technology and are not intimidated by the computer and/or computer lab, students teachers are much more likely to implement what they know in their teaching. However, one surprising variable we have discovered is that often student teachers' use of technology is stymied by middle school students' not having their "technology policy" permission slips signed by parents. If students do not have these permission forms filed at the school, they cannot fully participate in the class activities; teachers and student teachers are hesitant to use technology in such circumstances.

Research Update

To date, the cohort of students who are about to enter student teaching acknowledge that they will never know everything about technology because, according to Alice, "even the saviest technology people do not know everything." They believe they have "broken down [the] barriers of insecurity in using technology," (Rose) and will, as Paula suggests, continue to "work on those 'stumpers' "--i.e., tools she is not yet completely comfortable using independently.

Encouraged to discuss ways in which they intend to use technology in their teaching, even the students who have philosophic concerns about technology interfering with the human touch acknowledge ways to "bridge" people across the world through technology. Barb says she will "embrace [technology], look at it and manipulate [it] as a tool for empowerment." She wants to have students learn about global issues and reach out to people who might not be reachable in any other way than through email. Her students, then, will "form relationships and establish bonds, which may open new dialogue" among groups. By examining the motivations and intentions of email, web sites, and technology, they will become critical users.

When these students are asked to list the kinds of technology tools they will use in their own teaching, they include student-created web sites, real-time chats, videoconferencing, digital archives, writing process through computers, E-PALS connections, global connections with other cultures, scavenger hunts, and numerous activities we have used in both classes. This list is a far cry from the blank screens of the students' first narratives. They see the potential for enhancing their teaching through technology, and they know they will be continuous learners as well as teachers.

Challenges to Technology Infusion

Judy, as a result of her work with Carol and other pedagogy content specialists at the university, notes that the initiative to infuse technology into teacher preparation poses special problems for pedagogical content specialists. Professors like Carol have been preparing preservice teachers for many years. Now they are called upon to prepare future educators to be technologically literate while they are also making the transition to new forms of instructional delivery. They face such obstacles as 1) insufficient personal knowledge and skills in technology, thereby creating anxiety and frustration that accompany any learning curve; 2) expecting themselves to model and infuse technology skills before they have mastered the skills themselves; 3) inadequate time to research underlying principles upon which successful practice can be based.

The challenges facing the pedagogical content specialists prompt equal challenges for instructional technology specialists who may, as graduate students, be paired with professors to assist them. Thus their collaboration time is limited because of the demands of both their roles. And, although individualized, just-in-time training may seem realistic and beneficial for personal growth, these teachable moments may not be sufficiently comprehensive. At the same time, the technology assistant's expertise may not be in the same area as the professor, thereby establishing the necessity for collaborative planning and learning. In such situations brainstorming ideas and strategies that are relevant, engaging, and successful for both the instructor and the students is critical.

Conclusions

The primary goal of teacher preparation should be that the infused technology appear seamless and be used only as it improves teaching and learning. However, basic computer skills are necessary before the learners (whether they be professors or students) can comfortably grasp and employ advanced processes. Both assistants and professors need to allow time for basic skill development through short lessons during class as well as applying the skills to the content pedagogy itself.

In our experience, the professor-assistant-student trio has been both rewarding and challenging. Every person in the triptych is both a learner and a teacher; therefore, each person serves several different roles. The teaching/learning field is level and shared; the preservice teachers then see an active model for technology infusion--one which requires an equal sharing of roles and responsibilities and one which honors the myriad opportunities to fill blank screens with full directories.

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A Technology Consultant Model Implemented In A Project-Based Pre-Service Teacher Education Program

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Introduction

A recent national survey on the preparation of new teachers to use information technology (Moursund, 1999) reports that most college and university faculty do not model the use of information technology skills and most student teachers do not routinely use technology during field experiences. Topp's (1996) also revealed that recent graduates of teacher education programs felt that their preparation for using technology was inadequate because their programs did not include modeling of technology uses in methods and general education classes. Almost certainly related to the problem of limited faculty modeling of information technology in the university setting is the fact that faculty who adhere to a traditional professorial role may intentionally avoid using technology, fearing that it will reveal their lack of expertise and undermine their instructional authority. Moreover, the fear of appearing technologically inept is magnified by the familiarity and experience students frequently have using technology in other settings. Ironically, the very technology skills we hope to develop in students may undermine efforts to introduce new teaching technologies to classrooms by intimidating teachers. The traditional professorial model simply will not work under these circumstances and that, in part, seems to be the reason there is such widespread interest in alternative approaches to teaching with technology (Duffy, & Jonassen, 1992). The professor as a facilitator of learning is one particularly powerful example that has been used with technology-supported case analysis (Cognition and Technology Group, 1990; Risko, 1995) and problem-based learning (Savery, & Duffy, 1995; Barab, Hay, & Duffy, 1998).

The Project

This federally funded project (Preparing Tomorrow's Teachers to Use Technology, PT3) places digitally literate pre-service teacher education students and experienced, highly effective educators in a mutually supportive, collaborative environment. The ultimate goal of the project is to increase the number of in-service educators modeling effective integration of technology for our pre-service students both in classes across the university and in education field experiences,

Students participating in the grant (consultants) enroll in a 4 credit course, IST 464 Consultation: Technology Applications in Education which meets once a week for two hours and includes activities and guidance in the development of consulting skills and educational technology applications. This course is designed to help students integrate knowledge from any education major/minor with educational applications of technology.

Student consultants work for 10 hours per week throughout the semester in an applied field setting in either an urban or a suburban school system, or at Oakland University, with experienced educators (clients) who are interested in increasing the integration of technology in their classes. The consultants' goals are to help the clients learn technology integration skills that support the clients' teaching styles and curriculum needs. In addition, as they learn about what an already effective teacher actually faces in his/her efforts to integrate technology our students develop strategies to overcome these inherent challenges.

Major Activities and Findings

September through December 1999 was spent getting project personnel, systems, and preparation for the pilot offering of the technology consultant course in place. From January through April, 2000, primary

personnel hiring was completed, the project website was launched and the technology Consultant course was piloted with eight pre-service teacher education students (consultants). These student consultants were matched with five university professors and three K-12 teachers (clients). Many lessons were learned as a result of the pilot offering of the course and were implemented in the first full offering of the Consultant course which occurred in Fall of 2000. Eighteen pre-service teacher education students enrolled in the Consultant course and were matched with three university faculty members and fifteen K-12 educators.

As a part of the project evaluation, all consultants and clients were interviewed at the end of the Fall semester. Despite a number of challenges which will be identified below, all participants described the experience as extremely worthwhile, and all would recommend the experience to their peers. When asked of the likelihood of the project experience changing classroom teaching there was a unanimous positive response. Consultants were very strong in their certainty that the consultant experience will impact their use of technology in the classroom. In particular, consultants indicated that they had crossed a "confidence threshold", a "competence threshold", and had come across many ideas of how to integrate technology into the classroom. Without a doubt, fundamental mental shifts have taken place in the awareness of the project consultants. Clients expressed similar sentiments. Many commented that it was so different having on-going technology support as opposed to sporatic technology workshops. They felt that the support enabled them to work through some of the barriers that prevented them from actually implementing applications they had learned about.

Challenges encountered included: lack of technical resources in client environment, lack of time on the part of the client, adjustment to the role reversal between experienced educators and pre-service teacher education students in the client and consultant roles, potential role conflict when students were also doing traditional field placements with the same K-12 educator, and competing demands of work, family and other courses on time of student consultants. This last issue, busy student schedules, is the project's greatest hurdle in recruiting students to enroll in the Consultant course. Our challenge is to create a "don't miss" reputation for the course in the minds of our potential students.

In summary, we believe that the model presented in this paper, provides a long-term solution to the "lack of modeling and use of technology in pre-service teacher education" problem in university classrooms and in field placements. Essentially, in this model pre-service education students help university professors and in-service teachers create effective learning environments for them, and ultimately, for their own students.

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Visualize This: PT3 Project InSight Develops Three Resources to Promote Visual Communications

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Abstract: As part of its activities funded by the U. S. DOE as a PT3 Implementation Grant, Project InSight, led by a consortium at the University of West Georgia, has three objectives to promote more visual communication of ideas and skill training among preservice students and faculty. These objectives include: (1) expanding a video-based school-to-university network link among six partner school districts and the university; (2) developing a series of video demos illustrating effective instructional uses of adaptive/assistive technologies; and (3) developing virtual reality and 3D environment examples to illustrate diagnostic applications and instructional uses of these emerging technologies in meeting special needs of students with disabilities. This presentation will describe the Year 2000-2001 activities and progress on accomplishing these objectives, and demonstrate the products developed to date for each.

Introduction

As the University of West Georgia developed a three-year Implementation Proposal as a follow-up to its Capacity-Building grant, it became evident that more visual communications were destined to play an increasingly greater part in our efforts to infuse technology into our preservice program. After considering our needs and the potential role of "face-to-face communications at a distance," we designed three different activities that would further visual communications and set the stage for similar activities in the future.

Expanding a Video-based School-to-University Network

One of the most successful efforts in the Capacity Building phase of our PT3 work was putting in place and testing a streaming video link between a local school district and the university. Evaluations of this activity reflected a high level of excitement shared by university and K-12 faculty about the link's potential. It became clear that many of us felt that more visual communications can improve the quality of teacher education in two key ways:

- By immersing preservice teachers into classroom activities at a distance; and
- By allowing teacher education faculty to include distant K-12 classroom activities into on-campus learning.

During the initial year of the Implementation grant (2000-2001) year, we are involving schools in additional partner districts in the network by accomplishing the following steps:

- Assisting our partner school districts (with funds and technical expertise) to obtain and implement high-speed connections between their sites and ours;
- Testing the links for each school/district site with a basic set of instruction-related activities we have designed to make use of the current link in classes and during internships;
- Initiating additional communications capabilities in schools to supplement our streamed video capability with additional video capabilities over the Internet (e. g., with EnVision); and
- Integrating the video activities as components in our teacher education program.

Developing a Series of Videos on Adaptive-Assistive Technologies

A need that has been identified and acknowledged by many preservice programs is additional training to prepare non-special education content area teachers to meet the needs of children with mental and physical disabilities. All too often, teachers receive substantially less training than they need in this area, not because they or their programs consider it unimportant, but because of limitations on the number of hours they can take in their programs. Courses in their content areas and in basic methods of teaching children in certain age groups must take precedence over other courses and skills.

To make it more feasible for faculty to provide training within current courses that will prepare preservice teachers to meet students' special needs, we are developing and providing training to faculty on a set of transportable, easy-to-manage materials they either can use in courses or have students use outside class. This set of materials would combine existing print and video materials with the video-based demonstrations we will develop. The proposed video demonstrations would make the content and delivery of this information more visual and, thus, easier to use outside class. They also would provide more graphic illustrations of how teachers can use technology-based tools to meet the special needs of students in inclusion classrooms. Special Education faculty will work with local teachers to develop these videos. Steps to accomplish this task include:

- Obtaining copies of existing materials on this topic;
- Developing video demos to illustrate technology uses and package it with print materials;
- Placing videos in our Support for Infusing Technology Center and disseminate them via our web site; and
- Providing presentations with infusion suggestions to teacher education faculty in all areas.

Developing Virtual Reality (VR)/3-D Examples That Meet Special Instructional Needs

Virtual reality (VR) technologies and other 3D environments have been talked about for years in terms of their potential for meeting needs of students with disabilities. As Roblyer & Cass (199) noted, "VR could allow students with disabilities to learn certain skills:

(a) with greater physical and/or emotional safety,
(b) in a more timely and cost effective way,
(c) in ways that do not highlight their disabilities,
(d) in a manner that does not interfere with the general public, and
(e) in a way that better meshes learning and learner characteristics."

Yet this obvious potential remains largely untapped. Two primary reasons have accounted for this discrepancy. First, not many educators have skills required to design VR programs. Second, the cost of designing and implementing good quality VR capabilities has been relatively high.

However, recent developments in VR software have made it increasingly feasible to develop VR environments with relatively low levels of technical expertise and at a comparatively reasonable cost. In order to illustrate the uses of VR environments in meeting special learning needs, we are using SuperScape's *VRT Development Software* to develop two kinds of model VR environments with this lower-cost software:

- **Virtual Shopping** - Using video footage of popular shopping areas, we are developing an environment to train students with mild mental handicaps to learn and practice a series of shopping and purchasing activities. This training product is being designed and developed in conjunction with K12 special education faculty and teachers. Once in draft form, it will be field tested with students and evaluated for its transfer to real situations.

- **Spatial Mobility Training** - To help students with physical and mental challenges learn to negotiate spaces in buildings during emergency and non-emergency situations, we will design a model simulations in a school building, test it out with students with physical and mental challenges, and evaluate them for transfer to problem solving skills in buildings under real conditions.

Summary

All these activities are in keeping with our project's theme of "InSight" we have gained into the resources that are needed by preservice faculty and students if they are to infuse technologies into their instruction meaningful ways. During the presentation, we will discuss these needs, our insights about how to meet them, and the tasks we have undertaken thus far. Finally, we will demonstrate products we have developed to date under each objective.

Faculty Development as an Agent of Technology Change: Implementing a Shared Vision

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Abstract: This paper will describe first year efforts in reference to a PT3 Implementation grant. The grant promotes an alliance between two very diverse institutions of higher education. One university is a historically white public institution while the other is a small historically black private institution. Both institutions are implementing a series of initiatives to transform their respective teacher preparation programs. Using shared resources, these initiatives include an extensive program of faculty development in instructional technology for both arts and sciences and teacher education faculty. Significant changes to both institutions technology infrastructure provide faculty, preservice teachers, and classroom teachers with significant technology support, including individual assistance and a lending library of software and portable technologies. Using these support services, university faculty are modeling the use of instructional technology in their courses and increasing the use of technology into course assignments.

Introduction

A historically white public institution and a small historically black private institution partner in their faculty development efforts as part of a PT3 Implementation grant beginning the 2000-01 academic year. Through this grant, two diverse universities are jointly implementing a series of initiatives to transform their respective teacher preparation programs. Significant changes to instructional technology facilities at both universities are providing faculty, preservice teachers, and classroom teachers with significant technology support. Using these support services, faculty will help preservice teachers develop the needed knowledge and skills to infuse technology into content-based instruction.

As part of first year initiatives under the PT3 grant, one focus has been on ensuring that faculty receive training on the use, operation, and integration of technology into their respective curriculum areas. A recent survey of faculty (conducted during a 1999-2000 PT3 Capacity Building grant) at both institutions revealed a pressing need for improving faculty development and for providing assistance with infusing technology into teaching. Faculty also reported reasons for resistance to integrating technology throughout the teacher education curriculum. Approximately half the faculty identify classroom resources, costs of hardware and software, inadequate time for training, lack of motivation and knowledge, and costs of ongoing support systems as barriers to more use of technology. Other comments state that while training sessions are available, they may not be convenient or targeted to specific needs related to content and the skill level of each faculty member. This suggests that general training sessions need to be followed by opportunities for individual consultation to target training to meet specific needs. A primary need for both faculty and preservice teachers is enhanced availability of intensive training.

Solutions: A Starting Point

In an effort to respond to faculty needs for technology training and assistance with the use and integration of technology into curriculum, the following initiatives are currently being offered: *Goal One*: Offer technology resources, training programs, support and other opportunities to faculty at both universities.

To accomplish goal one, 16 faculty per year in teacher education programs and 14 faculty per year in Colleges of Humanities and Sciences at both universities are being provided with course release time.

This release time will provide faculty with opportunities to develop and infuse instructional technology into their courses and to serve as leaders in their respective disciplines. Because both universities require that prospective teachers earn a BA or BS in a Humanities and Science major, it is imperative that H&S faculty infuse their use of technology into their curriculum. While the release time initiative is just underway, a previous Capacity grant awarded during the 1999-2000 academic year has demonstrated the strong effect that release time can have on the use and integration of technology into instruction.

Faculty who have obtained release time over the 1999-00 year have actively learned about technology and incorporated it into their respective disciplines. Faculty represent a variety of program areas: elementary education, middle education, high school education, and special education. For example, a professor of science education has learned to use the new QX3 computer Microscope and then infused its use into his courses. His students, in turn, have used loaner microscopes to teach lesson in area schools.

A professor of special education has devoted time to learning about assistive technology and software. In his classes, the professor is demonstrating touch screens and other hardware devices that provide a variety of methods for inputting information. Second, he is demonstrating to preservice teachers how computer operating systems can be programmed to accommodate students with special needs.

Humanities and Sciences professors have also actively learned about infusing technology into their classes. A professor of English is using Web Course in a Box to deliver instruction to her students and to model how technology can be used for instructional purposes. This same professor is also serving as a technology resource in the College of Humanities and Science, regularly visiting fellow professors to demonstrate the use and integration of technology.

These representative samples show how our Implementation Grant is allowing university faculty across disciplines opportunities to learn about new technologies; infuse technology into courses; share technology skills and strategies with their students; and serve as mentors to other faculty who wish to expand their knowledge about effective uses of technology for instruction. VCU and VUU faculty are also collaborating on technology infusion projects, technology conferences, seminars, and other activities that encourage faculty from both universities to learn from one another.

Faculty who have obtained release time, or are in the process of requesting a course release during the grant period require a great deal of guidance, training, and one-on-one assistance with technology. Hence, Goal Two: Improve the operation of the Department of Education Computer Lab at VUU and the Instructional Technology Center (ITC) at VCU.

VUU is expanding its collection of multimedia capable laptops and enhancing its collection of peripheral equipment such as scanners and digital cameras. At VCU the ITC has extended its capabilities by adding an "Infusio" Laboratory that provides "hands-on" assistance for faculty at both universities to incorporate technology into their classroom instruction. The Infusio Lab will also serve as a distribution system for the checkout of hardware and software technology resources.

The School of Education at VCU, for example, currently operates an Instructional Technology Center (ITC) that provides an initial base of technology support and equipment for students, staff, and faculty. The Center houses thirty computer workstations along with scanners and printers. Digital and video cameras, some educational software, and other technology-related resources are available for checkout. Some faculty assemble students in this facility to demonstrate the integration of technology into K-12 educational settings. In addition, workshops geared for faculty and staff provide opportunities to share ideas and technological innovations with peers.

The facility is often used as a classroom space by professors who utilize technology throughout their coursework. ITC personnel are also responsible for managing portable equipment and cataloging and checking out educational software programs. As a result of Virginia Commonwealth University's commitment to infuse technology throughout its curriculum, the ITC has experienced a large increase in use and an increased demand for instructional support provided by ITC personnel. The growth in usage of the ITC has led to a need for more physical space and staffing. For instance, a multi-year grant awarded to us in Fall of 1999 has provided us with funds to purchase new educational software titles. Our growing software collection requires a significant time investment by current personnel. Titles must be cataloged, stored in a secure location, and checked out to faculty, students, and teachers throughout the greater Richmond area. The expansion of software selection has increased the checkout of the materials by faculty and students.

To accommodate the needs of our university faculty, preservice teachers, and classroom teachers, the current ITC is being enlarged by adding a Laboratory center known as "Infusio". Three graduate

students are employed to manage and operate the facility. One of these graduate assistants will receive an increased stipend and be designated the lead director of the Infusio lab.

Personnel employed in this facility will have four major responsibilities: 1) Provide "hands-on" assistance for faculty to incorporate technology into their classroom instruction; 2) Offer training and support to student teachers and practicum students, with an emphasis on infusing technology into curriculum; 3) Provide technical assistance on the use of portable and handheld technology for faculty and students; 4) Provide greater access to and security for our expanding software collection.

Staff at Infusio will also be responsible for creating a Web site that will serve as a master information medium for all grant participants. The Infusio Web site will disseminate ideas, lesson plans and strategies for infusing technology into various curricula. Additionally, discussion forums will allow consortium partners to share ideas and concerns with others in the field. This model of asynchronous communication will foster the sharing of ideas across boundaries. Synchronous chat rooms will allow grant participants to share ideas, concerns, and general information in a "real-time" environment. Interested parties can discuss ideas without assembling a large group of participants from several geographic locations.

Conclusion

The central component of our project is that it allows us to provide systematic training and ongoing support for faculty to develop and apply technology skills to enhance their teaching and, specifically, to model effective technology-related instructional strategies. The development and implementation of cross-institutional experiences are fostering a sharing of ideas, resources, and technology expertise to accomplish a common mission – to use technology as one tool to meet the needs of diverse K-12 student populations.

Simultaneous Renewal in Teacher Education: Strategies for Success

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Abstract: To adequately prepare preservice teachers to use technology in their own classrooms, teacher education programs must develop comprehensive models for technology integration that include meaningful uses of technology to improve and renew the teacher education curriculum. In addition, model K-12 sites must be fostered where preservice teachers can practice using technology to create active learning environments for students. Integrating technology effectively into teacher education courses and working collaboratively to create rich technology field experiences are both tremendous challenges for teacher education programs. Given the needs and challenges that both K-12 schools and teacher education programs face with respect to effective use of technology, it appears that both entities would benefit from collaborative work to address these needs. John Goodlad's theory of simultaneous renewal for colleges of education and K-12 schools provides a useful framework for this type of collaboration. This paper describes several strategies that faculty at Iowa State University have used to successfully integrate technology throughout the teacher education program and in K-12 classrooms.

A primary focus of the majority of teacher education programs is to graduate teachers who have had meaningful experiences learning with technology in their courses and who have worked in technology-rich K-12 classrooms where children actively use technology to facilitate the learning process. Throughout their preparation program, preservice teachers must experience, observe, analyze, critique, and learn with technology. As a result, teacher education programs must develop comprehensive models for technology integration that include meaningful uses of technology to improve and renew the teacher education curriculum. In addition, model K-12 sites must be fostered where preservice teachers can study the integration of technology into teaching and learning. Integrating technology effectively into teacher education courses and working collaboratively to create technology-rich field experiences are both tremendous challenges for teacher education programs.

Given the needs and challenges that both K-12 schools and teacher education programs face with respect to effective use of technology, it appears that both entities would benefit from collaborative work to address the problems. John Goodlad's theory of simultaneous renewal for colleges of education and K-12 schools provides a useful framework for this type of collaboration. Goodlad has observed:

> "What comes first, good schools or good teacher education programs? The answer is that both must come together. There are not now the thousands of good schools needed for the internships of tens of thousands of future teachers. The long-term solution - unfortunately, there is no quick one - is to renew the two together. There must be a continuous process of educational renewal in which colleges and universities, the traditional producers of teachers, join schools, the recipients of the products, as equal partners in the simultaneous renewal of school and the education of educators." (Goodlad, 1994, p. 2)

Iowa State University is using Goodlad's theory to the guide the effective use of technology for learning and teaching throughout its teacher education program. Technology as a tool to improve teacher education is the primary vision that drives the comprehensive technology in teacher education program in the College of Education at Iowa State University. This approach involves technology integration initiatives and strategies that impact the entire teacher education curriculum, including collaborative efforts with other colleges and K-12 schools. In recognition of these efforts, the American Association of Colleges for Teacher Education (AACTE) presented Iowa State University with the "Best Practice Award for the Innovative Use of Technology" for the year 2000.

This paper will begin with a brief overview that summarizes several technology integration strategies that have been used with Iowa State faculty and students for the past ten years. Then, the paper will describe additional integration strategies that have been designed as part of Iowa State's Preparing Tomorrow's Teachers Today (PT3) implementation grant.

Background: A Comprehensive Approach to Technology and Teacher Education

For over a decade, technology use and integration has been a major initiative for faculty and students in the College of Education at Iowa State University. Several technology integration initiatives have been designed that enhance faculty development, teacher education courses, field experiences, and extracurricular activities for students. These initiatives include a nationally-recognized technology mentoring program for faculty, a school-based technology integration model that creates technology-rich field experiences for students, a minor in educational computing, and teacher education courses in which faculty members model effective uses of technology.

The Department of Curriculum and Instruction in the College of Education has identified, designed, and implemented technology experiences that enhance teacher education courses, field experiences, and extracurricular activities for students. These experiences have been developed in the context of a large department (35 FTE faculty, 30 joint-appointment faculty, and 14 adjunct or temporary instructors) with approximately 1000 undergraduate elementary education majors and 450 secondary education students. In 1991, the college voted to include technology integration as a major initiative. Both the dean of the College of Education and the department chairs associated with teacher education provide leadership and commitment to the goal of effective technology use in teacher education. In this context, several programs have been collaboratively developed to support technology integration efforts in the College. The following sections provide brief summaries of programs that were developed to support this initiative.

Faculty Development: Technology Mentoring Program

A primary goal of the College of Education's technology integration plan is to provide all faculty with the tools they need to make technology infusion a reality. In 1991, a mentoring program was established to assist faculty interested in technology integration, as well as to provide students with opportunities to develop individual, professional relationships with faculty members in their program. Cited as an exemplary national program in the 1999 CEO Forum Report, the mentoring program has resulted in successful professional development for more than 70% of the teacher education faculty.

Course and Curriculum Redesign: Technology Integration in Methodology and Content-Specific Courses

Not only are ISU preservice teachers required to design and use technology to complete course assignments, but they have many opportunities to observe faculty members modeling effective uses of technology in their courses. Some examples include:

- reading faculty members illustrate literacy assessment and diagnostic tools by using digital video case studies
- special education instructors use laptop computers to teach how preservice teachers can access and fill out electronic forms to document the progress of special needs students
- preservice teachers in social studies methodology courses use e-mail and discussion groups to communicate with preservice teachers at other universities to discuss themes and issues related to the social sciences

College of Education faculty members also work collaboratively with College of Arts and Sciences faculty and College of Engineering faculty to design courses that connect content and pedagogy using technology. For an introductory science course, meteorology and education instructors have created computer-based simulations designed to engage students in constructivist, inquiry-based learning activities. Faculty in the Colleges of Engineering and Education have implemented a "Toying with Technology" course that actively engages teacher education students in the design and construction of simple models of real-world systems.

Field Experiences: Collaborative Learning Communities

Based upon the faculty technology mentoring program, a similar program was extended into PreK-12 classrooms. This technology integration model promotes the collaborative efforts between preservice and inservice teachers. Participants include teachers and students from school districts, instructional technology consultants from an Area Education Agency (AEA), and faculty and students from the College of Education. This model provides school-based opportunities for preservice and inservice teachers to work together as mentors to examine methods for integrating technology effectively into classroom learning environments and helps to establish technology-rich field experiences for students.

In-depth Preparation: Educational Computing Minor

A minor in educational computing is offered by the College to provide in-depth experiences for students who wish to pursue leadership careers in technology. Established in 1984, this minor provides preservice teachers with comprehensive learning experiences that prepare them to use technology throughout the PreK-12 curriculum. Over one hundred students are currently enrolled in the minor. They take fifteen credit hours of coursework that includes classroom applications of technology, distance learning and the Internet, PreK-12 technological innovations in engineering, and field-based practicums in technology-rich schools.

Extra-curricular Activity: The Educational Computing Club

Undergraduate students are encouraged to develop leadership skills and pursue outside activities that contribute to their professional growth. Established in 1995, The Educational Computing Club (TECC) is an undergraduate student organization whose membership consists primarily of preservice teachers. Each year, TECC members organize and participate in a variety of activities. Examples of these activities include working with teachers and students in PreK-12 classrooms; assisting faculty, staff, and students in the College of Education with the use and integration of technology; writing grants to secure funding for technology; and sharing expertise by presenting ideas and projects at state and national conferences.

The technology in teacher education initiatives summarized here were designed to develop and define specific technology tools and instructional models that prepare teachers who can use technology in innovative and effective ways in classrooms. Even though this multi-faceted set of approaches has already positively impacted the teacher education program, additional strategies have begun to evolve from and expand upon these initial activities because of the PT3 support. In the next section, some additional integration strategies that have been initiated in the department will be described.

Additional Strategies for Successful Technology Integration in Teacher Education

The purpose of Iowa State's PT3 implementation grant entitled, *Technology Collaboratives for Simultaneous Renewal in Teacher Education*, is to create a strong collaboration between a school of education and K-12 school districts as both work simultaneously to infuse technology into teaching and learning. One goal of the project is to establish a collaborative learning community where there is a sharing of expertise and resources to rethink how technology can be integrated and used effectively in college and K-12 classrooms. Specifically, this collaborative effort embraces a vision of technology as a tool to facilitate renewal in both a teacher education program and K-12 schools. Because of this vision, several grant initiatives have significantly contributed to expanding and enhancing the use of technology throughout the teacher education program and in the partner

schools. These strategies include: 1) establishing a cohort model preservice teacher program, 2) assisting 'technology scholars' (teacher education faculty) as they redesign their courses to infuse technology experiences for students, 3) working with a master teacher from the collaborating school district, 4) increasing the quantity and quality of K-12 field-based experiences using technology, and 5) providing collaborative activities to support K-12 teachers.

Technology Cohort Group of Preservice Teachers

Based upon the successful Project Opportunity cohort model developed at Iowa State University, a technology cohort of students in teacher education (TechCo) has been formed. Twenty-eight students were selected based upon their academic credentials, previous work with children, and technology interest and experience. This cohort group of preservice teachers will take their teacher education classes together beginning their sophomore year. During fall semester 2000, these twenty-eight students were enrolled in a field experience course that included twenty-four hours of field work in schools and a one-hour weekly campus seminar.

TechCo students will take each of their professional education and methodology courses as a cohort. As TechCo students progress through the teacher preparation program, they will enroll in the several courses (teaching strategies, methodology, field experiences, inquiry, and capstone) as a group. In addition, the TechCo students will take four courses required for the educational computing minor and will have the option to take the additional two courses to complete the minor's requirements.

To promote the use and integration of technology in courses and out in the schools, the ISU preservice teachers in this cohort were given the opportunity to purchase Apple iBooks at a discounted price. Twenty-one of the twenty-eight students purchased iBooks. Additional iBooks were purchased to provide access to students for checkout. The iBooks have wireless networking capabilities available both on campus and in the partner school sites. Having access to this technology has promoted and supported a 'wired learning community' where preservice teachers are observed using the iBooks in a variety of settings: classrooms, hallways, outdoors, and at home.

Teacher Education Faculty Technology Scholars

Iowa State's faculty mentoring program is well documented. For over ten years, teacher education faculty in the Department of Curriculum and Instruction have participated in a mentoring program that provides them with graduate and undergraduate student support as they learn to use technology. Even though the ISU mentoring program has been extremely successful, teacher education faculty members still need more time to learn about specific technologies and to develop technology integration ideas for their classes.

Building upon the existing mentoring program, teacher education faculty were given the opportunity to participate in a professional development activity designed to provide them with an extended period of time to focus on sharpening their own technology skills and to design technology experiences for students that would enhance their courses. So far, six faculty members participated in this activity. Each faculty member was given the option of a one-course release or one-month summer salary. These faculty members were soon nicknamed the 'technology scholars' because of their intense focus on developing meaningful ways to use technology that informs scholarship and practice.

In addition to providing faculty with time to work on these initiatives, other resources were available to support their efforts. A graduate student in curriculum and instructional technology provided additional support and one-on-one mentoring upon request. The graduate student was also available for course material and resource development. In addition, the 'technology scholars' met as a group with PT3 project directors for an hour each week to share their weekly celebrations. These sharing sessions were extremely valuable because the technology scholars gained ideas from each other as ideas were exchanged and discussed.

Master Teacher from Collaborating School Site

In order to facilitate communication between the university and the collaborating school sites, a master teacher from the participating school district was hired. The teacher was selected based on her interest in the position and because of her effective use of technology in her own classroom. The master teacher spends half of her time working in the schools and half of her time on campus at Iowa State. While at the collaborating school sites, the master teacher provides technology support for the inservice teachers involved in the project. The master teacher

conducts model lessons in teachers' classrooms, facilitates workshops for teachers, and provides one-on-one consultation with teachers when requested. At Iowa State, the master teacher teaches one lab section of the required introductory instructional technology course and helps organize and schedule the collaborative project activities between the school sites and the university. Having a master teacher working as a liaison between the university and the schools has been an essential and a necessary component to successful project implementation.

Increase the Quantity and Quality of K-12 Field-based Experiences Using Technology

Other project goals include providing additional and extended field experiences for preservice teachers and creating model technology-rich field sites for field-based experiences. The school sites will provide opportunities for preservice teachers to use technology in K-12 learning environments for course practicums and field experiences. In order to increase the quantity of field-based experiences for preservice teachers, both teacher educators and inservice teachers have begun to redesign the structure of practicum experiences so preservice teachers can spend more time in classrooms while taking teacher education classes.

As indicated earlier, the twenty-eight TechCo students were enrolled in a field experience course that included twenty-four hours of fieldwork in schools. The primary purpose of this 'early' field experience was to begin working collaboratively with teachers in the partner schools and to observe teachers in PreK-12 classrooms (at times modeling technology use in classrooms). Instead of placing each preservice teacher with one teacher for the entire experience, each student was placed with a different teacher for a nine-week rotation. Using this format, the ISU preservice teachers observed nine different teachers teaching at different grade levels (PreK-12). Students appreciated having this field experience early in their preparation program. Next semester, the TechCo students will have another field-based experience that will be connected to a teaching strategies course.

Collaborative Activities to Support K-12 Teachers

For change to occur and be sustained, personnel from both universities and schools must work together to implement and support school reform efforts that impact instructional strategies and technology use. A variety of staff development activities were designed to assist and support teachers' use of technology in classrooms at the partner school sites. These activities are delivered in multiple formats: traditional large group, classroom modeling, consultation and collaborative group settings. The most successful staff development strategy has been to schedule at least one inservice day per month at each school. Teachers are released from their classrooms for a 90 minute session, so they can work one-on-one with an ISU faculty member or an Area Education Agency (AEA) technology consultant. Prior to these sessions, teachers must submit a brief description of what they intend to work on during the session and how the activity is connected to curriculum standards and benchmarks.

Summary

Collectively, these integration strategies are positively impacting the use and integration of technology throughout the teacher education program at Iowa State University. Based in a teacher education program that is known for its work in integrating technology in teacher education, these combined efforts are providing the framework needed to sustain a technology-rich teacher education program. Using Goodlad's theory of simultaneous renewal as a foundation, this teacher education program is continually working in partnership with others to develop a comprehensive model that uses technology to facilitate teacher education renewal.

References

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Meeting the Accountability Challenge—Electronically

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Abstract. The teachers who graduate from our nation's teacher education programs will face an increasing professional challenge of accountability in their classrooms. Public schools are hearing an escalating call to arms to raise the standards of the performance of our students. Raising the standards for our students translates directly into raising the bar for our teachers. High stakes tests for college admissions of high school students are not the only major benchmark of student success nowadays. Middle and even elementary school teachers are preparing their students for high stakes benchmark exams. Under the microscope of political and public scrutiny, teachers are being held directly accountable for their students' performance in ways that did not previously exist. Pre-service teachers need the immediate attention and support of the mentors who are preparing them to enter this high stakes arena. How do technology and accountability intersect teacher education?

The teachers who graduate from our nation's teacher education programs will face an increasing professional challenge of accountability in their classrooms. Public schools are hearing an ever-louder call to arms to raise the standards of the performance of our students. Raising the standards for our *students* translates directly into raising the bar for our *teachers*. Under the microscope of political and public scrutiny, teachers are being held directly accountable for their students' performance in ways that did not previously exist. High stakes tests for college admissions of high school students are not the only major assessment of student success. Middle and even elementary school teachers are preparing their students for benchmark exams. Pre-service teachers need the immediate attention and support of the mentors who are preparing them to enter this highly charged arena.

To ensure academic success for all students, educators need a clearly-defined curriculum. What objectives does our state, district, and/or standardized assessment tool measure? How can we know that what's being taught is what's being tested? How can we know that all our teachers are "on the same page"? With accountability mandates voiced more and more publicly over the years, states and districts have responded at different rates and different levels of urgency, with varying implementation strategies, timelines for curriculum development, and methods of holding teachers and learners accountable. Districts with well-established curriculum teams have found themselves in a continual cycle of curriculum revision: once a curriculum has been developed, it is only a matter of time before revisions and updates require time-intensive modification or even overall restructuring. State guidelines change. Teachers or administrators who were not part of the original development team enter the district. Key supporters of a curriculum revision leave. A different norm-referenced test is designated as the new high-stakes assessment tool. Even without the "given" of such external changes, internal data from local assessment, standardized tests, and classroom assessment by individual teachers call for updates and changes in a dynamic curriculum.

Most states have done an efficient job in providing documents outlining the expectations for students to the school districts and their teachers. This monumental task of curriculum development and realignment has traditionally been accomplished during summer months and late nights, with state, district, and local personnel teaming up to correlate massive amounts of information *by hand*. Curriculum teams work like Sisyphus to integrate all of the "non-negotiables," to ensure no objectives were eliminated, to set ups naturally progressive sequences with one grade taking responsibility for mastery, and to reduce

redundancies to a minimum. The documents that result are often cumbersome and hard to implement. The sheer volume of a well-defined curriculum makes it hard to respond gracefully and swiftly to external and internal changes. And, if that weren't challenge enough, the relationship between the curriculum document and high-stakes tests is often unclear to the very people who will be directly implementing the curriculum—classroom teachers.

With increasing demands on time and professional resources, many districts began searching for more efficient ways to manage curriculum development, revision, and alignment to ever-changing mandates. I was part of the curriculum development team in one of those districts. We wanted to produce dynamic curriculum documents that clearly related what was being taught to what was being assessed on high-stakes tests, both at the state and national levels. We found that such documents *can* be produced and implemented—and that technology can help keep them current. technology equip pre-service teachers to engage in--and impact--this situation? Fort Osage School District, where I taught for <# of YEARS> before coming to EdVISION Corporation, used curriculum development software to create a fluid, working curriculum that helped increase student test scores up to 43%.

A Manual Curriculum

In 1996, I was working as a math teacher for a third year at Fort Osage School District in Independence, Missouri. Missouri had just sent out the "Show Me Standards" and, as part of the state review of school districts, required the integration of these standards into curriculum at the district level. I became involved in an intensive curriculum revision process as a member of the math curriculum team. Seven math teachers, ranging from grades K-12, met in the summer in a conference room. A lead teacher had been asked to guide the process in all areas to provide consistency. Because of my technical background, I was soon elected the "technical lead." We cut and glued, we argued and protested, and after a week had a document that we called our "curriculum." We soon realized that we needed a template in which to input all of the documents written. Somehow, I was chosen to design and implement a relational database for our curriculum guides. I spent the next 3 summers working on the writings and revisions of our curriculum.

Our curriculum team eventually involved almost 200 of the 350 teachers in the district in the writing process over those 3 summers. Teachers worked in content groups over the summers to develop documents that were consistent with the Missouri State Frameworks and had appropriate progression between grade levels. These three years were quite intensive, the culmination of a total of five years of developing and revising a curriculum by hand. The lead teacher and I were quite proud of what we had accomplished. Late in August 1997, we delivered seven 3-ring notebooks full of color-coded curriculum documents to each building principal and each board member got a complete set of the entire curriculum. The board members didn't want to take theirs home (seven notebooks must have been too much to contemplate). This should have been our first indication that these documents would never be used.

Undaunted, we placed our hope in the expected response from grateful teachers. We had worked so hard to accomplish this massive output, and had involved so many of our colleagues in the decision-making process, that we felt teachers would enthusiastically embrace the new guidelines. A few weeks into the school year, the lead teacher and I admitted we'd been wrong. Documents sat on shelves and were not being used. Teachers continued to teach the way they always had. There was no change-- except for the sag in the district shelves on which the notebooks sat.

The Electronic Curriculum

In August 1998, our Assistant Superintendent asked the lead teacher to sit in on a session of the Administrator's Back-to-School Meetings. Because I had been leading the technological side of the District's curriculum implementation, I was asked to sit in on the meeting as well. In this meeting, a representative from an educational software company presented a program that would design curriculum aligned to state standards *electronically*. We were reluctant to believe that a product could make alignments better than the teachers themselves in just a few clicks. We were even more taken aback when we were told that our district was going to purchase the program. Another shock came when the lead

teacher and I learned *we* would be the ones to implement the new software into the curriculum process. My understanding of the technical processes driving the software had, in short, promoted me to implementation management of a district-wide initiative.

In the fall of 1998, Fort Osage purchased Curriculum Designer software from EdVISION Corporation (formerly Tudor Publishing Company) and set up a hands-on training workshop on campus. Our initial skepticism turned into jubilation. We realized we could take our existing document, transfer it into the program's database, and compare our document to the state standards, standardized tests, and state test that we gave in the district. What an exciting thing to actually *see* the objectives students would be tested on!

We put the curriculum so lovingly and laboriously created by teachers into the product and ran comparisons, matching Fort Osage objectives to the Missouri state framework document, the MAP (Missouri's state test), and the Terra Nova, ACT, and SAT (the national standardized tests adopted by the District). We started with our Math curriculum and matched all of our teacher-created objectives to the state objectives and national test standards in the *Curriculum Designer* database. Surprisingly—and despite the seven, color-coded 3-ring binders our long summers of curriculum building had produced--we found gaps and overlaps. Once the Math curriculum was aligned, we repeated this process for the other content areas, and then followed up by adding our non-core subjects to the program. Curriculum teams continued to discuss the movement of objectives when necessary or the addition of new objectives we did not have in our current document.

Next, alignment between grade levels became an issue: grade level teachers were no longer isolated. Grade level teachers discussed who would introduce, who would master, and who would reinforce specific content objectives. Grade levels with too much material were able to share objectives with other grade levels to balance the load. The teachers responded with great enthusiasm over the work we were doing. Suddenly, teachers and administrators did not have to "guess" what needed to be included in the curriculum. We had it in front of us. Teachers were free to focus on teaching.

We still had to face the hard fact that most teachers did not utilize print-based curriculum documents. Our assistant superintendent had had a vision years before of putting curriculum on "every teacher's desktop." What, we asked, if we disseminated the curriculum through a web-based application? Would teachers feel less overwhelmed? I spent that summer creating our district curriculum web pages. My concern was keeping the web-interface "point and click" so that it wouldn't cause any stress on teachers to learn something new. We had over 240 courses entered and each of these had to have an Adobe .pdf file created for it. Link pages were set up so that teachers could view courses by grade level or content area. There were also links to allow searching the entire K-12 curriculum or each subject area in its entirety.

Fort Osage's curriculum was ready for the Internet. Would teachers be willing to train to use the web pages to access their curriculum and other information? We decided to hold trainings the 2nd week of August on a voluntary basis. We sent a letter to every teacher with possible dates and times the trainings would be held. This was strictly voluntary and there was no compensation provided. I was given a voice mailbox and the teachers were told to call this number with their choice of time for training. I checked the box 3 days later and it was *full*. Over 40 teachers had called within a day's time. The calls continued to roll in; I ended up training over 2/3 of the staff members that week. What made it exciting was that teachers stayed after the trainings to look at the curriculum documents, print them out, and discuss *curriculum* with each other.

This excitement continued throughout the school year. Teachers gave up their time voluntarily to learn more about using the curriculum website. Conversations in the halls started to include how to teach specific objectives to the students. Collaboration multiplied, and staff members began to share resources. Teachers became involved because they knew the written (or in this case, electronic) document was not guesswork, but an accurate reflection of what the students needed. There was a definite change of focus from the teachers' standpoint. They were no longer having to wonder if they were teaching what the students would see on the test: now they *knew* what the students would see.

When testing came, there was not a panic two weeks prior to test time to "cram." Teachers felt very comfortable that the students were prepared as best they could be. We took the state tests and waited for our scores.

When test scores came, they exceeded even our fantasies. In eight of the twelve MAP tests administered, we made gains greater than the state in moving students into the two highest achievement levels, Advanced and Proficient. Fort Osage also had fewer students scoring in the two lowest

achievement levels than the state average in seven of the twelve MAP tests administered. While the state increase was 20.27%, Fort Osage saw an overall 43% increase in all grade levels tested.

The software

Curriculum Designer software, designed by EdVISION Corporation, is a computer-aided design tool used by curriculum developers to quickly generate curricula that meets the needs of their district and state. A team of content and assessment experts reviewed state and national documents, identifying over 72,000 learning objectives for Mathematics, Language Arts, Science and Social Studies to develop a massive database of objectives. This database is correlated to national standards, state frameworks, state tests, and standardized tests.

This software does electronically what curriculum developers traditionally have spend hundreds of hours and thousands of dollars to do manually. The program sorts through testing and standards documentation in order to ensure alignment to state frameworks, tests and national standards. Curriculum Designer drastically reduces the time and money spent creating an effective curriculum, making this entire process much more efficient and manageable. Curriculum developers are no longer required to develop goals and objectives, arrange and rearrange instructional sequences, and write lengthy reports. This software efficiently automates these tasks, allowing for state mandated changes to be quickly enacted.

Electronic curriculum design is especially effective in crafting a clear plan of instruction that details what students are to know in a particular grade or course. Included in the final curricular documents from Curriculum Designer are "learner will" descriptions of clearly defined learning objectives. These statements are consistently written to allow for a unified language within the curriculum. Also included are Bloom's taxonomy codes for each skill which help to offer insight into the curriculum's goals.

Curriculum Designer's Instructional Hours feature projects a teaching time for every identified objective within its database. With this information, the user can organize the curriculum's objectives for each area and course by the hours needed to teach each objective, balancing the limited number of hours in the classroom with the required amount of time to teach the outlined skills. Such a check is valuable to ensuring there are enough hours to accomplish the teacher's task in the school year.

Other features of Curriculum Designer include sequencing, editing, entering resources, and printing the curriculum. The Sequence folder arranges units and objectives in the order to be taught, easily allowing for revision to reflect a change in the teaching sequence. The Editing feature is a multi-faceted tool used to create, include, remove or relocate any objectives, competencies or units within the curriculum. The ability to add instructional and assessment resources is featured in the software as well, which can provide teachers with a complete guide to district resources available to them. Finally, curriculum developers can provide printed reports in a variety of formats, including information for administrators, teachers, parents, and students as needed. A special feature allows the curriculum to be exported to the Internet to be published in HTML format on a web page.

Generating a curriculum electronically allows teachers to produce a dynamic curriculum that is responsive to change. New mandates, changes of personnel, or the adoption of different high-stakes assessments don't have to mean hours of painstaking rethinking and revision. Allowing the software to do intensive searches of massive amounts of data frees teachers up to do what they do best—teach our students. At Fort Osage, we found all these reflected in higher test scores.

Conclusion

A year after implementing the electronic version of their curriculum, Fort Osage students returned some of the best test scores ever seen in the district. In some areas, the gain was over 40%. Overall, scores improved in 45 of 72 areas. These gains were accomplished with just one year of focus on the curriculum. What changed? Aligning the curriculum and assessment electronically got the curriculum documents off the shelf and into the hands of the teachers. The electronic curriculum documents allowed Fort Osage to give teachers clear, current, readily updateable, accessible guidelines of what should be taught so that they could refocus their energies in addressing how to teach.

The adoption of an electronic curriculum at Fort Osage and many other schools around the country represents a paradigm shift in education. Systemic change is being sparked by the escalating urgency driving accountability mandates. As states and districts attempt to respond to the additional administrative demands placed on them, a great deal of administrative work is being shifted onto the classroom teacher. With this extra workload comes the (often urgent) opportunity to become change agents in their schools and their districts. Our pre-service teachers may soon find themselves involved in the implementation of system-wide change in the districts that hire them. This is especially true for those who have a technical background. Their ease and expertise in technological solutions such as the electronic curriculum described here can promote them into positions of leadership early in their careers.

What does that mean for teacher-educators, who are training teachers to move into this time of transformation in our public schools? The teachers and administrators in training now will be hired, at least in part, because of the technological background they're acquiring as pre-service teachers. New hires with technological backgrounds will tend to be relied on for specialized projects that their "non-electronic" colleagues won't. They can bring fast, cost-effective technological solutions to processes once done manually, at great time and expense. This ability will cause them to be put into positions of accelerated responsibility. In short, they will be *required to be* change agents.

Our technically-oriented pre-service teachers are much more likely to be listened to as problem-solvers than other workers just entering a profession. They are much more likely to be recruited into systemic reform projects or "administrative" roles (even if their job titles don't immediately reflect that). Because technology can accomplish the kinds of change I've discussed here, new hires with technical training come in with a "halo" effect. The district, at least initially, hopes their ease with technology can make them strong change agents within the district's own development strategies. The more pre-service experience these students have with innovative software solutions like the one I've outlined here, the more likely they are to transform this "halo" effect into solid career accomplishments.

More than ever, we are preparing the next wave of change agents for our schools—and the change they'll be involved in has a distinctly electronic face. As teacher trainers we can help pre-service teachers who will already be entering a district with great expectations placed on them to *confirm* those expectations. We can train them now to carve out solid positions for themselves within the district so that the initial "halo" of potential becomes a solid record of achievement.

Preparing Tomorrow's Teachers to use Technology: Developments and Strategies of Ten Grantees

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Abstract: There is a substantial demand to integrate technology into teacher education programs. Future teachers are not prepared to effectively integrate technology into the classroom. Emphasis is placed on the concept that effective programs are needed in order to produce technology-adept teachers. This paper describes project activities from 10 Preparing Tomorrow's Teachers to Use Technology (PT3) grantees. Information was gathered from the PT3 web site, grantee web sites, and project members via electronic mail. Developments focus on revamping teacher education programs. Strategies include facilitating teacher and methods faculty workshops, and building interactive web sites and video based web instruction.

Introduction

Dialogue among educational scholars upholds the concept that future teachers are not equipped to properly integrate technology into the curriculum. "There is much rhetoric today about the inability of teacher preparation programs to fully prepare new teachers to use technology effectively in their professional practice" (Morsund & Bielefeldt, 1999). Computers are not utilized effectively in the classroom. The past two decades have proven the computer is no longer an additional tool in the classroom it is now essential (Puma, Chaplin & Pape, 2000). Teachers are hesitant to use computers because they lack training and are incapable of adjusting to technological evolvements. Research suggests that the traditional teacher preparation programs are not up to par in the field of integrating technology (National Center for Education Statistics [NCES], 2000). It is crucial to have teachers in the classroom who possess the ability to integrate and utilize technology. Once technology is effective in the classroom the teacher will become a facilitator of learning as opposed to a source of information (Office of Educational Research and Improvement [OERI], 1999). It will not be easy to re-educate existing teachers with out professional development that provides the same technology literacy skills required of students (National Council for Accreditation of Teacher Education [NCATE], 1997; OERI, 1999). Teachers must perceive technology as interesting, not an added chore or a waste of time. Future teachers will not appreciate the value of the computer if their practicum experience is with a teachers who think efforts to integrate technology will hinder routine work (NCATE, 1997; Wang, 2000). In addition to teacher apathy, faculty members themselves are not fully aware of the evident demand. "Not using technology much in their own research and teaching, teacher education faculty have insufficient understanding of the demands on classroom teachers to incorporate technology into their teaching" (NCATE, 1997).

Currently, teacher preparation programs are undergoing several changes. Morsund & Bielefeldt (1999), emphasizes teacher education programs are not properly training teachers to implement technology into the classroom. Trainers in the field of educational technology should provide effective support to teachers; a simple additional course or a staff member who happens to know how to use a computer is not deemed adequate (NCATE, 1997; OERI, 1999). It is difficult to provide students with adequate training in technology, because special "technology funds" are not highly prioritized (NCATE, 1997). "In an effort to help schools, colleges, and departments of education meet the increasing demand for technology-proficient teachers, the U.S. Department of Education established the Preparing Tomorrow's Teachers to Use Technology (PT3) grant program" (Planning and Evaluation Service [PES], 2000).

The PT3 program awards three types of grants: Capacity Building, Implementation, and Catalyst. Capacity Building grantees receive one year of support while Implementation and Catalyst grantees obtain funds for a total of three years. Capacity Building grants are awarded to institutions at the beginning phases of technology-based endeavors. Implementation grants focus on local initiatives to revamp existing teacher

education programs. Catalyst allowances uphold institutions that currently maintain commendable resources to make statewide, regional, or national improvements.

Selection of Grantees

Ten grantees were randomly selected from the PT3 web site (**Error! Reference source not found.**): one Capacity Building, four Catalyst, and five Implementation. The capacity building grantee is Southwest Texas State University. Catalyst grantees include The University of Northern Iowa, Louisiana Systemic Initiatives Program, Mississippi State University, and Maryland State Department of Education. Selected Implementation grantees include New Mexico State University, Bowling Green State University, West Virginia University, Boise State University, and Wichita State University. A database search was conducted on the PT3 web site by entering components of desired projects for review. Components selected were taken from the categories of grant type, content focus, and grade level. Project summaries were reviewed and web sites navigated. Grantees selected have distinctive information readily available and a site that is easy to navigate. Project members were contacted via electronic mail for project descriptions with no universal resource locator (URL) listed. The project members made reference to the project name and web site. Project activities, which encompass developments and strategies, were reviewed. Activities examined include goals and objectives, partnerships established (consortium), and project initiatives (local, regional, statewide or national).

Developments and Strategies of Grantees

Project overviews document consortia that consist of universities, schools, school districts, and partnering institutions. Grantee websites present goals, objectives, and project activities. Projects, URLs, and activities are described below.

Capacity Building Grantee
Southwest Texas State University

Southwest Texas State University facilitates workshops for faculty members demonstrating how to designing web pages, web quests, and web-based forms and tests. The project is called *The Viewing and Doing Technology Project* (VDT), which may be found at: Error! Reference source not found.. The overall goal is to nurture a university and school partnership to launch a new teacher education program. The project members work with 20 high school sites and approximately 300 students. The partnership is between Southwest Texas State University and Hays County Independent School District. The secondary methods courses serve as the focal point. The plan is to restructure the process by having education courses taught outside the college of education. Select faculty members receive training in areas of expertise. Professional Development workshops are an ongoing process. Practicing teachers take part in a summer course and secondary student teachers are assigned to them. Taking the summer course ascertain the placement of students with cooperating teachers proficient in technology.

Catalyst Grantees
The University of Northern Iowa

The University of Northern Iowa's project is InTime, an acronym for *Integrating New Technologies Into the Methods of Education* at **Error! Reference source not found.**. This is a national initiative encompassing a consortium across five states. The consortium members include: University of Northern Iowa, Eastern Michigan University, Association for Educational Communications and Technology, North Central Regional Education Laboratory, Emporia State University, Longwood College, and Southeast Missouri State University. Universities assure that faculty members will have access to resources and technical support. Selected faculty members participate to gain information on how to revise methods courses. Each university hires a full time graduate student to trouble shoot on the web site and offer assistance to faculty members who want to learn about new software and equipment. Participating methods faculty receive a stipend. The best

practices in the classroom are taped and are posted on the website. Videos are displayed by descriptors such as content area, grade level, state, lesson title, and technology competency.

Louisiana Systemic Initiatives Program

Louisiana Systemic Initiatives Program is located at **Error! Reference source not found.**. THE QUEST, *Technology in Higher Education: Quality Education for Teachers and Students*, is a statewide initiative. The consortium members include Louisiana Board of Regents, Microsoft Corporation, Louisiana Governor's Office, Louisiana Systemic Initiatives Program and the Louisiana Department of Education. THE QUEST provides assistance and professional development for faculty across the state of Louisiana. Faculty members involved teach introductory educational technology courses, other faculty members, and methods courses. K-12 teachers serve as mentors and supervisors. Two centers for professional development are strategically placed in the northern and southern parts of the state. Teaching, Learning, and Technology Centers (TLTC) are located in Louisiana Tech University in Ruston (northern area) and the University of Louisiana at Lafayette (southern area).

Mississippi State University

Mississippi State University's initiative may be found at **Error! Reference source not found.**. The project is entitled *Preparing Teachers to Deliver Technology-Rich, Problem-Based Learning Experiences*. This is a statewide initiative. Consortium members involved are Jackson State University, University of Mississippi, Mississippi State University, and the University of Southern Mississippi. Technology rich problem based instruction is provide for faculty at the university and community college level. Hands-on projects take place throughout course work. Consortium members conduct all training workshops. Workshops are individually scheduled for faculty, teachers, and student teachers. As works shops progress, training materials are developed and serve as online references. A project web site is implemented to share information among students, teachers, and faculty.

Maryland State Department of Education

Maryland State Department of Education project is found on the web at **Error! Reference source not found.**. This is a statewide initiative, which includes a partnership between St. Mary's College of Maryland, Salisbury State University, Towson University, Bowie State University and Anne Arundel Community College. Additional institutions working on this initiative include, Wor-Wic Community College, Anne Arundel County Public Schools, Baltimore County Public Schools, Howard County Public Schools, Montgomery County Public Schools, Prince George's County Public Schools, Johns Hopkins University, and Maryland State Department of Education. Frostburg State University, University of Maryland at College Park, Maryland Higher Education Commission, and Human Resources Research Organization are included in the consortium as well. The primary goal of the project is to align future teacher experiences with the state objectives. Performance based standards and assessments are developed through efforts of the consortia. Future teachers are expected to achieve outcomes outlined by the *Maryland Teacher Technology Outcomes*. Students produce electronic portfolios demonstrating their performance.

Implementation Grantees

New Mexico State University

New Mexico State University focuses primarily on integrating technology into multicultural instruction. The project name is *Preparing Tomorrow's Teachers Today*. The purpose is to restructure the teacher education and bridge the digital gap by placing an emphasis on diversity. Information may be found at **Error! Reference source not found.**. Consortium Members include Scholarly Technology, CETP-Collaborative for Excellence in Teacher Preparation, Gadsden Independent School District, Pathways for Teaching Science for Understanding in Diverse Classrooms, and Las Cruces Public Schools. The project focuses on increasing the number of technology-proficient teachers in the surrounding area to increase achievement among students of diverse ethnic backgrounds.

Bowling Green State University

Bowling Green State University's project found at **Error! Reference source not found.** is entitled *Project PICT: Preservice Infusion of Computer Technology.* Consortium members are Woodmore Elementary, Crim Elementary, Conneaut Elementary, Napoleon High School, Perrysburg High School, and Toth Elementary. The members of Project PICT work with elementary and secondary schools. Plans involve restructuring teacher education programs by aligning the curriculum with Ohio curriculum models, International Society for Technology in Education (ISTE) standards, and National Educational Technology Standards for Students (NETS). Duties are assigned to preservice teachers, cooperating teachers, methods faculty, and curriculum facilitators. Efforts are to develop lesson plans and activities for implementation throughout the course of study. Faculty members have mentors in whom they meet with periodically to enhance technology skills and activities.

West Virginia University

The project developed by West Virginia University is located at **Error! Reference source not found.**. The project is called *Trek 21: Educating Teachers as Agents Of Technological Change.* Project members work with 21 professional development schools (PDS) which are primarily located in rural settings. Consortium members are Taylor County Schools, Preston County Schools, Technology, Teacher Education, Tomorrow (T3), Harrison County Schools, Marion County Schools, and Monongalia County Schools. The plan is to systematically place a five year program where practice and modeling takes place. The project produces 15 core courses with technologically-enhanced classrooms. Students are placed in learner centered classrooms that aid in providing experiences that are real. Mini conferences are held throughout the semester.

Boise State University

Boise State University's project is located at **Error! Reference source not found.**. This project is called the *Bridges Project:Building Bridges With Technology.* Consortium members are Meridian Joint School District, Middleton School District, Midvale School District, J.A. Kathryn Albertson Foundation, Weiser School District, Boise State University, Payette School District, Homedale School District, Kuna Joint Schol District, and Twin Falls School District. The teacher prep program has online components. The project will focus on three different areas: faculty development, student fieldwork and the development of an on-line pre-serverice. Faculty will be given extensive training and support in skills and integration of technology into the content areas they teach. Students and professors spend time in the field with teachers who have had three years of training and practice with integrating content-based technology activities.

Wichita State University

The project at Wichita State University, found at **Error! Reference source not found.** is entitled *Models, Mentors, Mobility: Tomorrow's Technologically Astute Teachers* (Project M3). This local initiative concentrates on middle schools and elementary schools. Consortium members include: Haddock Computer Corporation, Wichita State University Office of University Computing and Telecommunications, Wichita Public Schools, Wichita State University College of Education, Apple Computer Corporation, Wichita State University Media Resources Center, Wichita State University Center for Teaching and Research Excellence, and Wichita Catholic Diocese. The focus is to model teaching in the classroom, provide mentors to student teachers, and take technology to the classroom as opposed to taking the students to technology. Project M3 provides content area resources on the web site.

Conclusion

The developments and strategies described clearly accentuate, "effective change does not come without adequate planning, vision, professional development, evaluation measures, technology resources and new institutional modes of operating" (OERI, 1999). The projects focus on faculty members at universities and preservice and inservice K-12 teachers on local, state, regional, and national efforts. Activities varied according

to site needs including location and demographics. Some institutions promote modeling programs while others rely on training and workshops. Project efforts include giving stipends to participating faculty members. Some sites focus on elementary and middle schools while other focus solely on high schools. Some projects engage students in beginning years of their program with hands on activities along with regular course work. Other institutions simply construct lesson plans for others to implement. The International Society for Technology in Education (1992) affirms proper change will not happen without "restructuring education through the applications of technology." Formulating these developments and strategies prove to serve as the long needed wake up call to the field of education.

This paper provided limited information on PT3 efforts to revamp teacher preparation programs. However, an attempt to briefly describe activities in progress is well worth the effort. Possible future evaluations may perhaps report effectiveness and the impact on student achievement. Researchers might deal more accurately with adjustments surrounding administrative duties and policies. Further exploration should convey how administrators deal with modifications in school structure. Finally, more attention should focus on how teachers deal with the classroom and curriculum revisions.

With steady momentum toward incorporating technology into teacher preparation programs, the PT3 grant developments and strategies guarantee future technology-proficient teachers. The goal of producing talented and competent teachers who include technology into every day practice is now more attainable. As teachers (Puma et al., 2000) are prepared for this new way of teaching, they will no longer serve as the "sage on the stage" but the "guide on the side" where learning will take place by means of practical applications within a technology enhanced curriculum.

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Learning to Integrate New Knowledge and Skills (LINKS): First Year Results from a Systematic Infusion of Technology into a Field-Based Teacher Education Program

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Absract: This paper details the associated research endeavor of a technology program designed to integrate emerging technologies into the teacher preparation curriculum at Texas Woman's University. The objective of this study is to describe changes in behaviors and attitudes as well as changes in institutional processes. Specifically, the study addressed these questions: (a) How was the teacher preparation program adapted to support preservice teachers' technology proficiency; (b) to what extent did preservice teachers build technological skills and demonstrate understanding; (c) how did mentor teachers build technological skills and serve as guides of technology integration for preservice teachers; (d) to what extent did university instructors model technology proficiency in web-based curricular delivery; (e) what concerns were expressed, and how did they change over time; and (f) what early implementation lessons were learned to inform program improvement? The program as well as the accompanying research, is supported by a USDE implementation grant entitled Preparing Tomorrow's Teacher to Use Technology (http://www.pt3.org). Specific program information can be located at: http://www7.twu.edu/~f_snider/links/

Introduction

Learning and Integrating New Knowledge and Skills (LINKS) is a three-year technology project designed to integrate established and emerging technologies into the teacher preparation curriculum at the Texas Woman's University (TWU). The project is supported by a U.S. Department of Education, Preparing Tomorrow's Teachers to Use Technology implementation grant. The LINKS program redesigns the teacher education program within the Professional Development School (PDS) at TWU to address the technology proficiencies desired by the schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE), and delineated by the professional associations. The project supports changes in university faculty involvement and roles, technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations.

The objective of this study is to describe changes in behaviors and attitudes as well as changes in institutional processes. Specifically, the study addressed these questions: (a) How was the teacher preparation program adapted to support preservice teachers' technology proficiency; (b) to what extent did preservice teachers build technological skills and demonstrate understanding; (c) how did mentor teachers build technological skills and serve as guides of technology integration for preservice teachers; (d) to what extent did university instructors model technology proficiency in web-based curricular delivery; (e) what concerns were expressed, and how did they change over time; and (f) what early implementation lessons were learned to inform program improvement?

Perspective

Recent efforts in the nations' schools have centered on the infusion of technology into classrooms. Although a great deal of training has occurred at the school level, reports suggest that new teachers entering

classrooms are not well prepared to use technology (CEO Forum on Education and Technology, January 2000). Currently, the debate centers on the best means to integrate technology into teacher education programs. Approaches range from encouraging students to use e-mail to more advance programs designed to infuse technology into all aspects of the teacher education curriculum. Recent innovations that have been implemented with varying success include electronic contacts via e-mail, listservs, and dialogue (Blake, 1998; McIntyre & Tlusty, 1995); virtual workshops, out-of-field certification, and add-on coursework (Simmons & Linnell, 1998, Veen, Lam, & Taconis, 1998), and more recently, comprehensive, integrated approaches (Dradowski, 1998; Parker & Farrelly, 1994, Schrum, 1998). Concerns about individual attitudes and perceptions that pose significant barriers to technology integration have been the focus of many recent research efforts (Blake, 1998; Buhendwa, 1996, Medcalf & Davenport, 1999; Smithey & Hough, 1999; Strudler & Wetzel, 1999). Though much research has been conducted, according to Shaw (1998) in his Report to the President on the Use of Technology to Strengthen K-12 Education in the United States, "a large scale program of rigorous, systematic research on ...educational technology...will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). Shaw further suggests that the rigorous evaluation of the programs we create is needed.

Project Overview

The Professional Development Center (PDC) manages the field-based teacher education program at TWU, and the LINKS technology integration project builds on the existing curriculum for teacher preparation. Each semester approximately 300 future teachers progress through university coursework, technology seminars, and field-based placements in Intern I, Intern II, and Residency. Responsibility for preparing students is divided among technology seminar leaders, university liaisons, and mentor teachers. The LINKS Technology seminar leaders support the LINKS preservice strand utilizing a distance delivery approach from the TechTrek website designed for use with this population (http://venus.twu.edu/~f_snider/ techtrek/main/index.html). As preservice teachers progress through Intern I, Intern II, and Residency, competencies related to four technology cornerstones (foundations, connectivity, productivity, and integration) are documented through course portfolios, classroom logs, desktop conferencing, and professor validation. Technology lab sessions and one-on-one interventions are offered to interns as they document their progress. All Intern I and Intern II preservice teachers are required to attend three whole-group technology seminars related to the four cornerstones; to participate in bi-weekly desktop conferencing groups that extend discussion related to course readings and indicators; to submit completed technology requirements and weekly reflections through e-mail; and to attend at least one lab session per semester that supports the development of their skills or relates to completion of the required indicators. As students complete coursework in their interdisciplinary major, they document demonstrated proficiencies in their LINKS Technology Passport a comprehensive metacognitive tool.

In addition to the preservice teacher population, full-scale implementation is achieved by orienting mentor teachers to the LINKS project goals and tools, and by extending professional development efforts to instructors on the university campus. Training opportunities, resources, and electronic means are provided to support instructors as effective models of technology use, in web-based course delivery, and in electronic communication with students. The instructor strand of the LINKS project assists university instructors with the preparation of web-based course delivery via Blackboard, the university's web-based course delivery template.

Methodology

In the first year of the project (fall 1999-spring 2000) implementation and outcome data were collected for events involving three populations: preservice educators, mentor teachers, and university instructors. During the fall 1999 semester, the first cohort of preservice students enrolled in Intern I (N=99), and participated in three technology seminars, bi-weekly conferencing groups, and documented proficiencies in the Technology Passport. Pre- and Posttests were administered to assess changes in technological proficiency and use, as well as attitudes and concerns. Nonparametric matched pairs tests were utilized for analyses of quantitative data for 67 students with complete data sets. Within this cohort group, 30 students were placed with mentor teachers in rural districts for field-based internships. Mentor teachers (N=30) participated in six, on-campus training sessions and received assistance designed to enhance positive attitudes and receptivity toward their intern's technology use. Mentor teachers completed pre-and posttests to assess their technological proficiency. Nonparametric matched pairs tests were utilized for quantitative analyses. For both preservice teachers and mentors, qualitative analyses were conducted for open-ended items on session evaluation forms. A volunteer sample of university professors (N=20)

agreed to participate in five whole-group professional development sessions. Sessions focused on an orientation to the Links project and resources, and the preparation of web-based course delivery via Blackboard—the University's web-based course delivery template. Pre- and posttest data were collected on the Stages of Concern Questionnaire (SOCQ) and data on the Levels of Use (LoU) were collected by individual interviews after the last of the five training sessions. Due to attrition, the final sample included 13 instructors. Analyses involved descriptive statistics and the creation of profiles.

Data sources

Implementation data were obtained from reviews of project documents, attendance records, evaluation forms, and information on LINKS-related web sites. Complete data sets were available for preservice teachers (N=67), mentor teachers (N=28), university instructors (N=13). The instruments utilized as data sources for the three populations are listed below.

Preservice teachers. Three quantitative measures were administered at the beginning of the fall and spring semesters. The measures included: Basic Technology Competencies for Educators (BTCE); Self-Evaluation Rubrics for Basic Teacher Computer Use and Internet Use, and the Stages of Concern Questionnaire (SoCQ). Nonparametric dependent-sample tests were used to determine whether significant differences existed across semesters. Qualitative data were derived from course evaluations to assess changes in attitudes about technology.

Mentor teachers. Mentor teachers complete the Self-Evaluation Rubrics for Basic Teacher Computer Use, Advanced Computer Use, and Internet Use at the beginning and end of their semester as mentors. Nonparametric dependent-sample tests were used to gauge changes in skills and use. Qualitative analyses were conducted for open-ended items on questionnaires completed by e-mail and on session evaluation forms.

University instructors. The Concerns Based Adoption Model (CBAM) was used to assess university instructors' progress toward the use of Blackboard. Pre- and posttest data were collected for the SoCQ. LoU ratings and open-ended Statements of Concern were collected by individual interviews after the last of the five training sessions.

Results

These findings represent preliminary analyses for the evaluation of the first semester of project implementation under the three-year grant. Results for preservice educators revealed that participants (N=67) considered themselves more technologically proficient after experiencing the integrated technology component of their professional development coursework. There were statistically significant pre- and posttest differences for all domains of the BTCE, 10 out of 11 domains on the Basic Teacher Computer Use, and all domains on Internet Use. Future teachers moved toward high impact concerns and relatively low self-concerns as measured by the SoCQ. Qualitative analyses revealed generally positive responses in relation to acceptance of and comfort with technology, as well as confidence in ability to integrate its use in curriculum delivery. Many preservice teachers were, however, concerned because they seldom saw technology use modeled in public school classrooms, and they believed access to technology would be a significant barrier to technology use.

Mentor teachers showed significant growth toward technology use in the classroom and more positive attitudes toward technology use. Statistically significant pre-and posttest results were obtained for 23 out of 27 domains on the self-evaluation rubrics for Basic Teacher Computer Use, Advanced Computer Use, and Internet Use. Qualitative analyses of open-ended items indicated that mentors were generally positive about program participation. Concerns related to time, scheduling, applicability, and involvement with interns. Mentors reported limited use of technology in the classroom by interns. Therefore, LINKS now plans for joint sessions for classroom pairs of interns and mentors. Mentor training for the next semester will be provided in a two-day workshop held on the TWU campus. Since this revised training provides for direct interaction between the mentor and the intern, it is consistent with the LINKS Management Plan for mentors and the goals of the PT^3 grant. This revised plan addresses the major concerns expressed by the mentors in this pilot and emphasizes the immediate applicability of new learning as well as effective use of professional time. Both mentors and interns indicated their support for working together in such an effort.

The primary goals for the university faculty were introduction of the LINKS standards and resources, and support for instructor delivery of web-based courses as models for the future teachers. The descriptive statistics and

profiles for the SoCQ suggested that the instructors had relatively high informational and personal concerns as well as rather intense consequence and collaboration concerns. Changes reflected in exit interviews related to the variance in beginning use and the individual differences in progress attained during the semester. All individual instructors made significant progress in levels of use, although they began at different levels. Qualitative analyses of open-ended evaluation questionnaire items revealed four key instructor concerns (a) the need for, and management of, time, (b) their individual technical proficiencies, (c) the applicability of Blackboard to their own teaching, and (d) their need for continuing support. To address expanded support, 14 training sessions are now projected for 2000-2001. University instructors will be supported over the entire academic year, and they will be provided with laptops for this effort. The outcome in the near future will be a web-based course offered by each participant. Support from the LINKS team during and between training sessions will be expanded and documented for evaluation purposes.

Educational Importance

Findings for the first year of LINKS implementation supported the efficacy of the system and the program being utilized. The three populations (preservice teachers, mentor teachers, and university instructors) made notable strides toward using technology in their own teaching and learning frameworks. All participant groups showed substantial improvement in their technological proficiencies, and participants provided valuable feedback that allowed the LINKS team to refine the program further to address their concerns and needs. These findings provide implications for increasing the technology proficiencies of entry-level teachers as well as providing a model for other universities undertaking similar changes in teacher preparation programs. Further, the resources created by LINKS are available to other institutions on the project web site. Findings have particular relevance to explain how university professors can be supported as effective models of technology use in web-based course delivery and electronic communication with students. The documentation of learner-centered standards for preservice teachers through the Technology Passport provides a much-needed model to monitor and assess changes in preservice teachers' technological proficiencies.

As the PT^3 sponsorship continues, the number of technologically proficient future teachers will increase, more university professors will use technology in course delivery, and ultimately, more future teachers will be prepared to integrate technology in K-12 classrooms. The LINKS team is committed to the facilitation of those changes. The first year's progress is reflected in the quantitative and qualitative findings, in program enrichment and expansion, and in the systematic design of management plans that addressed the identified needs of each population.

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Development of an ePortfolio Builder for Teacher Education

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Abstract: This paper describes and discusses designing and developing a prototype ePortfolio building system called iFolio that supports the online assessment and tracking of a pre-service teachers' ability to meet technology standards throughout their teacher education program.

Introduction

As information technology becomes ubiquitous in our society, schools have struggled to keep pace. While many reasons can probably explain this, one key reason is that teacher preparation programs have not been successful at adequately preparing preservice teachers to integrate technology into their chosen profession. The National Council for Accreditation of Teacher Education (NCATE) in their 1997 report stated: "Bluntly, a majority of teacher preparation programs are falling far short of what needs to be done ... teacher education faculty have insufficient understanding of the demand on classroom teachers to incorporate technology into their teaching." In response to the problem, the Department of Education has launched a major funding initiative, called PT3 (Preparing Tomorrow's Teachers to use Technology), which is directly aimed at supporting "the transformation of teacher preparation programs into a 21st century learning environment" (Department of Education PT3 Grant Overview, 1999).

At the same time, the International Society for Technology in Education (ISTE) has developed technology standards to help prepare teachers for technology-rich teaching and learning. They provide teacher education programs with standards describing what new teachers should know about and be able to do with technology when entering the classroom. These standards are likely to be adopted by NCATE and state and local educational agencies throughout the nation.

In this paper, we describe and discuss the experiences at Utah State University with designing and developing a system to help pre-service teachers document and track how they are meeting technology standards throughout their teacher preparation program. In particular, we describe a prototype ePortfolio building system called iFolio. Funded by a PT3 grant, this tool supports the online assessment and tracking of Utah pre-service teachers' ability to meet national and local teacher-technology standards throughout their entire professional teacher education program.

The design of the system is motivated by several design goals:

1. Provide an ePortfolio assessment system which is linked to national technology assessments standards, and is not limited to a single course, but can track student progress across the entire 2-3 years of their professional program.
2. Provide an online ePortfolio builder and extensive digital library system, which will permit students to easily enter and edit electronic portfolio items over an extended period of time in a password secure environment.
3. Provide a reflection and self-evaluation system that will help students take greater responsibility for their own professional development in meeting technology standards.
4. Provide a peer and professional review system within the iFolio system, where students and teacher education faculty can review and evaluate the technology artifacts and practices included in ePortfolios from other partner institutions.
5. Provide a system that organizes and links the digital artifacts and annotations with the related personal goals, reflections and peer review information.
6. Provide a means to output the resulting portfolio onto a CD-ROM or DVD disk for personal and professional use by the student.

7. Provide a metadata and collaborative filtering system for searching, ranking and recommending specific instructional objects stored within the iFolio digital library.

The project views the development of an ePortfolio by a student as a work in progress rather than a final culminating experience. Meeting the current national teacher technology standards is not an event that has a particular ending – pass or fail – point, but rather the standards become a target that challenges preservice and inservice teachers to constantly improve and update their skills in hitting the center point of the technology integration target. While the iFolio system establishes a minimum level of competency that each preservice teacher will be expected to attain, the system is designed to encourage its users to constantly reflect on the artifacts they have included in their portfolio, and to seek out ways to improve and extend their portfolio throughout their teaching career. The portfolio assessment system is built around a "levels of development" rubric that permits users to assess -- at various points in their program -- where they are in their personal development process.

The iFolio system allows the preservice teachers to:

1. View an online tutorial system that includes: a) instructions for using the ^{i}Folio system, b) context sensitive online help, c) recommendations for developing an effective portfolio, d) samples of model portfolio items, e) copyright and ethical information and guidelines, f) information about the ACOT stages of development.
2. Enter a personal statement containing their related professional goals, and an organizing framework and overview for their electronic portfolio.
3. Enter and edit portfolio artifacts throughout their preservice program within a password secured environment.
4. Include annotations with each artifact describing: where and when the work was done, conditions and constraints in place during the artifacts development, their role in the development of the artifact, and the scope of the overall project the artifact was selected from.
5. Associate artifacts and elements within the portfolio to specific technology standards.
6. Reflect on how each element or artifact represents achievement of the standards/goals and project future direction in advancement of that standard.
7. Reflect on items that are contained in other peer portfolios for useful ideas, and strengths and weaknesses found in those portfolios.
8. Link to the anonymous peer/professional review system.
9. Organize and link the digital artifacts and annotations with the related personal goals, reflections and peer review information.

Each portfolio must also include a statement affirming that each item in the portfolio represents their personal work as indicated in the annotations. Upon completion of the preservice ePortfolio requirement, student will be provided the option to output the resulting portfolio onto a CD-ROM or DVD disk for personal or professional use.

In addition to the student portfolio building components of the system, the ^{i}Folio system will provide:

1. A graphical standards completion tracking system to help individual students monitor their progress in meeting all of the required standards at acceptable levels.
2. A peer and professional review system to provide outside evaluation of student portfolios.
3. A metadata indexing system for items stored within the digital library.
4. A collaborative filtering system for ranking and recommending specific instructional objects stored within the library.
5. A limited authoring environment where the learning objects contained in the iFolio library can be combined and used in a variety of instructional settings

The system is flexible enough to permit students to include a wide variety of print and multimedia instructional artifacts in their portfolios. Artifacts might include such this as: lesson plans, an electronic resume, verification of meeting the university's Computer Information Literacy (CIL) requirements, web sites they have developed, or digital video recordings/case studies of students doing technology related activities. It also might include: audio captures lesson experiences, technology related literature reviews, technology resource collections

and instructional objects, exemplary assignments that integrate technology, articles for publication, technology related senior projects, electronic presentations, CBI projects, evaluations and/or technical reports, or conference presentations. Since the university's portfolio requirement will cross both curriculum and K-12 boundaries it is designed to accommodate as wide a selection of technology options as possible within digital storage and Internet delivery limitation inherent in such a system. Artifacts can be stored as Acrobat PDF resources, digital video/audio resources (10MB limit), linked resources, and text items.

The development of the iFolio system relies extensively on prior work in designing and implementing Internet-based educational digital libraries. A primary goal of these libraries is to provide users (including teachers and students) with a way to search for and display digital learning resources commonly called 'learning objects'. Examples of such educational digital libraries include www.smete.org, which offers a comprehensive collection of science, math, engineering and technology (SMET) education content and services to learners, educators, and academic policy-makers (Muramatsu, 2000). In Europe, the ARIADNE project has been developing a Europe-wide federation of repositories of multi-lingual, digital, pedagogical resources (Duval et al., in press).

As part of these efforts, researchers are developing digital library cataloging systems. Much like labels on a can, these labels, or data elements, provide descriptive summaries intended to convey the semantics of the object. Together, the data elements usually comprise what is called a metadata structure (LTSC, 2000). Thus, in typical educational digital library applications, learning objects are stored and labeled with a metadata record. This metadata record usually contains basic information about the object. This may include, for example, a description, technical requirements, rights management, and author demographics. These metadata records support searching and discovery of relevant objects.

We have chosen to view the iFolio system as a kind of educational digital library. As such, we are using the technical infrastructure of the smete.org digital library for our iFolio builder. We are defining student-generated portfolio artifacts as a type of learning object. Thus, throughout their pre-service career, students can contribute to and grow their own digital library collection. The learning objects that they store consist of technology-related projects that they complete during their education. In this way, their individual collection represents a documentation of their growing technology competence.

In addition, ISTE specified technology standards are used to define metadata elements to annotate and describe portfolio learning objects. Thus, as students add objects to their collection within the digital library, they are asked to describe how the object is linked to technology standards. In particular, as objects are added, students use a Web-based fill in form to associate them to specific standards. They are also asked to provide personal annotations (metadata) describing where and when the work was done, their role in its development, and other relevant information. These kinds of meta-comments about object development are stored as metadata for the contributed portfolio object.

For example, a student may choose to include a digital-video-case in their ePortfolio that shows them and their students during their student teaching / internship experience in an exercise where technology is playing a critical role in supporting instruction. The student may choose to annotate various segments of the video-case with short statements of how that portion of the case demonstrates their ability to meet the ISTE standards of: "plan strategies to manage student learning in a technology-enhanced environment," or "use technology to support learner-centered strategies that address the diverse needs of students," or a variety of other related standards. A single iFolio artifact can be used in this way to demonstrate and support the students' ability to meet a number of technology related standards.

As is usual in a digital library, students can search their portfolio collection, as well as those of their peers, to find and display objects. The portfolio metadata provide multiple search mechanisms for finding objects. For example, the metadata elements provide a way to search for artifact elements by standards requirements. In addition, the metadata provide a tangible means for tracking and assessing students' emerging competence in technology standards. Such assessment can be used to devise personal learning plans for meeting unfilled standards. Finally, the iFolio library can be accessed by professionals and/or peers at partner institutions for further review and comment.

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High Touch Mentoring for High Tech Integration

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Abstract: The Graduate School of Education (GSE) at George Mason University (GMU) is committed to developing new teachers who not only have the skills they need to develop and teach lessons with technology, but who also have the knowledge needed to distinguish between effective and ineffective uses of technology. In order to help the faculty achieve this goal, a concerted effort was needed to ensure that faculty's use of technology included a variety of advanced learning applications. We submitted a proposal and were awarded a Preparing Tomorrow's Teachers to Use Technology (PT3) Implementation Grant. This project involves pairing GSE faculty with K-12 teachers already proficient in technology for one-to-one mentoring. The K-12 teachers are helping the faculty redesign the teacher education curriculum to include technology, providing models for effective technology use, and demonstrating instructional software programs. The one-to-one support is being supplemented with Webcasts and "best practices" videos on integrating technology.

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Introduction

Despite the increasing demand for technology use in the classroom, many teachers (preservice and inservice) still feel they are ill-prepared to integrate these tools into the school curriculum. The ideal way to prepare teachers for incorporating technology into classrooms is by integrating technology-based learning environments into the college curriculum, with university faculty modeling usage (Sprague, Kopfman, Dorsey, 1998). However, a survey by the Milken Exchange (1999) revealed that most faculty, whether in colleges of education or in the disciplines, do not model the use of technology in their courses.

Even if other faculty do not offer a model of technology integration, it is imperative that faculty in our colleges of education take a leadership role and provide prospective teachers with the opportunity to observe uses of technology in classrooms. However, many faculty members do not know how to effectively integrate technology in their courses. Although they may have basic computer skills, there is a sizable gap between personal technology use and use in teaching. It is much easier to learn basic computer applications, which are often covered in workshops, than to find - or even know where to seek - effective models of technology use that will improve learning. A concerted effort will be needed to move faculty use of technology into a variety of advanced learning applications that can improve education.

Such improvement in education cannot occur through "one-size-fits-all" workshops, especially when it comes to the integration of technology. Faculty members need time to reflect on their own teaching practice and beliefs. They need to explore software appropriate to their content area and need support as they begin to implement new teaching approaches. The most effective way to move faculty members from personal use of computer applications to the integration of technology into their courses is through working one-on-one (mentoring) where individual needs can be addressed (Thompson, Hansen, and Reinhart, 1996).

Mentoring has often been used to provide support for beginning teachers. Mentor teachers take on a wide range of roles in helping new teachers become familiar with procedures and instructional matters and providing emotional support when needed. "Key features of the mentoring approach are that assistance is provided within the context of a personal relationship and focused on the individual needs of the protégé" (MacArthur, et. al, 1995, p. 47). A mentor helps the protégé obtain knowledge or skills needed in order to prosper in their chosen profession. To improve technology usage in preservice education, faculty members need a mentor who can enable them to use technology effectively and understand their anxiety about change. Such a relationship can provide faculty members with the support they need as they move from personal use of computer applications to the integration of technology in their courses (Sprague, Kopfman, Dorsey, 1998).

Preparing Tomorrow's Teachers to Use Technology Grant Project

In June 2000, the Graduate School of Education (GSE) at George Mason University (GMU) was awarded a Preparing Tomorrow's Teachers to Use Technology (PT3) grant by the U.S. Department of Education. The goals of the project are to: (1) fully integrate technology in the instruction of preservice interns; (2) ensure that preservice interns are skilled in and have experience with integrating technology into K-12 classroom instruction; and (3) disseminate broadly the resources and best practices this project develops for integrating technology in preservice teacher preparation.

Through this project, we hope to develop beginning teachers who will be able to distinguish between effective and ineffective models for using technology in education and who are able to develop and teach lessons that include technology as a tool to support teaching and learning.

Providing Mentors

This project involves pairing K-12 teachers with faculty in one-to-one mentoring relationships. The K-12 teachers were selected from three partner school districts (Arlington Public Schools, Fairfax County Public Schools, and Prince William County Schools). They were chosen based upon their effective use of technology to support the learning of their students and were matched with faculty based on content area and grade level. These teachers are providing models for the effective use of technology, are demonstrating various software and web-based programs that can be used in education, and are assisting the Graduate School of Education (GSE) faculty in redesigning their teacher preparation courses.

Each participating GSE faculty member has been assigned at least one K-12 teacher who serves as a mentor for one year. During the Fall semester, the faculty member spends time during the school day observing the teacher in his/her own classroom. The faculty member witnesses ways of teaching with technology and is exposed to a variety of software and websites. During the teachers' release time, the faculty has the opportunity to discuss what was observed.

Participating faculty will choose one course taught during the Spring or Summer semester that they want to revise to include the effective use of technology. They will spend time looking at resources provided by the teachers and reflect on ways they could use these resources in their course. They will also discuss these resources with the teacher and observe the ways teachers use these resources in their own teaching. During the following semester, the faculty will teach the newly revised course. The teachers will provide assistance to the faculty as they begin to integrate technology ideas in the course. The teachers will attend the course and serve as support for the faculty, providing technical assistance and making suggestions for improvement.

These same K-12 teachers will also work with the preservice interns during their field experiences. While working with the interns, the K-12 teachers will model effective uses of technology and help the interns use technology in their own teaching. This two tier approach will allow the preservice interns to see technology modeled in their teacher education courses by the GSE faculty, see the same kinds of models at their field experience sites, and practice these models with K-12 students. This should allow GSE to produce highly qualified teachers who are knowledgeable about technology and its role in teaching/learning and who have the skills to effectively integrate technology in their own teaching.

In order to ensure participation by the K-12 teachers and GSE faculty, incentives were included in the grant. K-12 teachers are being paid a substantial stipend and awarded three hours of class release time so they can meet with the faculty person assigned to work with them. Classes are covered by two GSE Doctoral Candidates who are assigned to assist with this project. Faculty were offered a course reduction for their participation. Sixteen

GSE faculty members and twenty-one K-12 teachers (some faculty chose to work with more than one teacher) are currently involved in the first year of this three year project.

Webcasts

In addition to the mentoring, training will also be available through the use of Webcasts offered by a local non-profit organization called Kidz Online (http://www.kidzonline.org). Kidz Online's mission is to teach all children about the technologies that will play a major role in their future, so that they will view technology as an opportunity and not as a threat. Its educational programs have "kids teaching kids" and are focused on out-of-school learning. Kidz Online's young volunteers from the suburbs teach at-risk children from inner city after-school programs basic on-line skills. It also has developed a computer graphics and animation program to teach more advanced multimedia skills for high-demand careers.

Through our partnership with Kidz Online we will produce a series of Webcasts, video-on-demand, and videotapes that will focus on teaching technology skills and integrating technology in K-12 classrooms and university courses. A revolutionary new technology and a key component to the project, Webcasting replaces the production equipment found in a high-end television studio, including multi-camera switching and special effects such as animation. Webcasting provides the power to simulcast live events such as corporate meetings, newscasts, conferences, classroom training, trade shows or even a talk show. These Webcasts may be viewed live which will allow for real-time interaction between the presenters and viewers via e-mail or chat.

The Webcasts will be twenty minutes in length and will focus on teaching technology skills and integrating technology in K-12 classrooms and in university courses. Curriculum for the Webcasts are being developed by K-12 teachers and faculty within the Instructional Technology Program in GSE. Webcasts will begin January 2001 and will be shown monthly. Webcasts will be available for faculty in GSE to use with their preservice students. Preservice students will be able to ask questions and interact with the host of the Webcasts using e-mail and chat. These Webcasts will be archived on the project website (http://www.techmentor.org) so faculty at other universities and K-12 teachers may have access to them.

Currently, we are in the process of developing curriculum for the first series of Webcasts. This series will consist of three 20 minutes segments and will focus on the use of idea processors in K-12 and university settings. The first segment will introduce idea processors and demonstrate the use of *Inspiration*. The second and third segments will focus on the integration of idea processors in Math, Science, Social Studies, and Language Arts curriculum. Discussion by the moderator will be complemented by video footage of K-12 students using *Inspiration* to accomplish curricular goals. Future Webcasts are being planned for WebQuests, On-line Resources, Databases, Spreadsheets, and Virtual Communities.

Recruitment of Participants

In August 2000, the project director (Dr. Debra Sprague) sent an e-mail message to GSE faculty asking for volunteers to participate in the project. Sixteen faculty members agreed to participate (Dr. Steve White was one of them). Dr. Sprague met with the faculty and explained the purpose of the project. She emphasized the importance of using technology to teach in a new way as opposed to adding "technology for technology's sake." She provided the faculty with suggestions of appropriate activities for using technology in their courses. Dr. Sprague asked the faculty to send her an e-mail with the title of the course they wanted to revise and any special considerations they wanted her to take into account when finding a teacher. For example, several of the faculty already knew a teacher in their content area who was using technology and asked to be paired with that teacher while other faculty members supervise interns in a particular school and requested to be paired with a teacher from that school. Wherever possible these requests were honored.

School personal from each district served as the liaison for locating appropriate teachers. The teachers were chosen based on the following criteria. First, they needed to be a good teacher who happened to use technology effectively in their classrooms. Second, to ensure their technology skills and knowledge they needed to have either conducted a technology workshop or taught a technology course for their school, district, or the university; have completed a Master's degree in instructional technology; or obtained a reference from one of the technology coordinators in the district. The twenty-one teachers selected to participate had met the criteria.

Status of the Project

Because of the high number of participants in the project we have run into some unexpected obstacles. First, during the 1999-2000 academic year, GSE redesigned all of its teacher licensure programs due to changes in state regulations. This led to new courses being developed and taught for the first time during the 2000-2001 academic year. Several of the faculty felt they were unable to give up a course due to this redesign. They felt they needed to teach the new courses at least once before hiring an adjunct to cover the classes. As a result, many felt they could not take advantage of the offered course release. This initially discouraged some from participating this first year. To try to assist the faculty and provide incentive to participate, the Dean's office agreed to allow faculty to count the course release toward summer payment (faculty receive summer money as though they had taught a course) or to use the funds for travel money so faculty could share what they had developed in their courses. This led to several faculty members agreeing to participate who had originally declined the invitation.

The second obstacle that needed to be overcome involved the difficulties of schedules. The teachers and faculty often found it difficult to schedule a time when they could meet. Some of the faculty were traveling and were not able to connect with their mentor right away. When they returned their mentor was busy with after school projects and could not always accommodate the faculty's schedule. Some of the pairs chose to meet on the weekends to discuss ideas for using technology.

Another obstacle involved some of the teachers who seemed confused as to the goals of the project. They did not understand that the faculty were going to visit their classrooms. This led to confusion by the faculty and the teacher. Originally, the advisory committee had planned a kick-off reception that would allow the faculty and teachers to get to know each other. This was canceled because the teachers had not yet been identified. As a result, faculty were given the names and contact information for their teachers and were told to contact them and arrange a visit. Had the reception been held, some of the confusion would have been clarified. To solve this problem Dr. Sprague met with the teacher-faculty pair and discussed the goals of the project. A timeline was developed and given to both the faculty and the teachers. This helped to clear-up the confusion.

Despite these obstacles we are seeing some success with the mentoring relations. Several of the faculty participating have expressed satisfaction with their assigned teachers. Two faculty members are in the process of developing new materials for use in their courses. One faculty member who teaches Science Method courses is developing a video on the use of probeware. Another faculty member who teaches Foreign Language Methods is developing a WebQuest to use in her courses. Upon completion of her WebQuest, preservice candidates will create a WebQuest of their own. The rest of the faculty are still exploring various aspects of technology and have not yet decided how they want to integrate technology in their courses. However, the majority of the faculty have expressed enthusiasm and excitement about this opportunity to improve their own teaching.

Because this project is just beginning it is too early to draw any conclusions about its effectiveness. The project is being evaluated by an outside consulting firm, *Rockman et. al.* The evaluation consists of on-line surveys, interviews with the participants, and observations of the university courses. Several PhD. candidates are also conducting research on the effectiveness of this project. Summaries of these research projects will be posted on the project website (http://www.techmentor.org) once they are completed.

Conclusion

This purpose of this paper was to describe the development and implementation of one PT3 grant. The process of developing mentoring relationships between the faculty and K-12 teachers was discussed. Specifically, the selection criteria for selecting K-12 teachers as mentors for university faculty along with the goals and potential outcomes of the mentoring relationships were described. Discussion of the Webcasts that are being developed to focus on teaching technology skills and integrating technology in K-12 classrooms and university courses was shared. Specific obstacles that were encountered by project participants were also discussed. Strategies that were used to address and overcome different obstacles were included to further illustrate how ongoing communication and problem solving has been used to focus on the overall goals of the project.

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Using Technology Camps as Catalysts for Increased Technology Integration

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Abstract: A major challenge in engaging faculty members and K-12 teachers in in-service technology activities is the many demands and constraints on their time during the school year. A summer technology camp offers one approach for addressing this challenge by providing time for participants to interact and focus on technology in a relaxed atmosphere. This paper describes a technology camp that brought faculty members, K-12 teachers, and teacher candidates together for three days of technology related activities. A sampling of participants has been surveyed now that they are back in the classroom to determine the ways and amount they have used information and skills obtained in the camp. Practical suggestions based on the evaluations and the implementation of the camp will be described at the session to assist other educators interested in creating a similar camp.

The capacity building grant awarded by the U.S. Department of Education under the Preparing Tomorrow's Teachers to Use Technology initiative to a consortium led by Harris-Stowe State College provided a variety of professional development activities that brought together preK-5 teachers, college faculty members and teacher candidates. A major challenge in engaging such a diverse group in in-service technology activities is the varied demands and constraints on time combined with different academic calendars and schedules. One professional development activity designed to meet that challenge was the creation of technology learning communities (Stephen & Evans, 2000). A second strategy used to meet the goals related to professional development in the grant was the sponsoring of a summer technology camp.

Participants in Camp ETC, named for the project Edu-Tech Connect, met for three intensive days in August for workshops and hands-on activities designed to increase participants' expertise with technology and understanding of ways to integrate it into instruction. The camp format offered several advantages for the participants. These included a relaxed and casual atmosphere for learning, time to use information learned in workshops to develop materials for use in teaching, and a schedule that allowed participants to choose from a variety of workshops and activities. The camp also provided a setting in which faculty members, classroom teachers and teacher candidates could interact and exchange different perspectives on ways to use what was being learned in teaching.

From the very beginning, members of the camp planning committee found themselves confronted with a series of challenges and decisions that threatened to impact the success of the camp. The two main institutions, Harris-Stowe State College and Gateway Elementary Math, Science & Technology Magnet School are relatively small institutions with different schedules. They are not within walking distance of each other. In addition, while computer platforms at the two institutions are the same, the two institutions do not always support the same software for applications.

The first issue the committee confronted was the selection of dates and location for the camp. Administrators at Gateway Elementary offered to make two state-of-art computer labs available in either of two weeks following the conclusion of their summer school for use in the camp. Unfortunately, the summer session at Harris-Stowe overlapped those two weeks, but one of the college's computer labs was available for use during either week. The dilemma that the members of the camp planning committee faced became how to offer

a schedule that would not eliminate participation by Harris-Stowe faculty members and teacher candidates involved in the learning communities, but also involved in the college's summer session. Since few of the college's classes met on Friday and other classes followed a Monday-Wednesday or Tuesday-Thursday meeting pattern, the decision was made to schedule the camp for three days, Wednesday through Friday and to offer camp workshops at both locations on Wednesday and Thursday. This schedule enabled college faculty and students involved in summer school to participate in at least some camp activities.

An even greater challenge arose when the committee tried to plan workshops that would satisfy a range of interests and technological expertise. Since participants did not receive compensation for their involvement in the camp, planners were challenged to be creative in designing three days that would appeal enough to possible participants so they would be willing to commit their time freely to the camp. A variety of strategies was used to accomplish this, including early input from potential participants on topics of interest, a schedule that allowed participants flexibility in selecting topics and activities ranging from in-depth workshops to short activities such as using the computer to make mouse pads, plenty of vendor supplied free items, opportunities for fellowship and even a technology-related version of "Who wants to be a millionaire?" game. A survey of potential participants at both institutions resulted in the identification of some common areas of interest: strategies for using search engines, web page design, creation of electronic portfolios, use of presentation software, and creation of projects using graphics packages. While members of the planning committee had expertise to teach these sessions, the decision was made to contract the teaching of the courses through the director of technology instruction for a consortium of local school districts. This offered several advantages including freeing committee members to participate in sessions and to act as trouble shooters when needed, the ability to use and tailor already created workshops to meet the participants' needs, and the availability of workshop instructors who regularly worked in the prek-12 environment. In cases when the institutions used different software for particular applications, such as web page design, similar workshops were held simultaneously at both sites, but using the software supported at that site. Beginning workshops followed by more advanced workshops were offered on topics where participants had different levels of expertise. In the all-day formats, mornings were devoted to more structured instruction, with the afternoons focusing more on time to develop materials to meet specific instructional needs with the workshop instructor available for assistance.

Members of the technology learning communities were targeted initially for participation, with additional spaces made available to other faculty at the college and magnet school. Student members of the learning communities worked in various capacities at the camp. Resources were available for 50 participants. While members of the planning committee feared that splitting the sessions on the first two days between two different sites might lead to separation of college faculty and students at the college facility and classroom teachers at the magnet school facility, that fear turned out to be unfounded.

Participants were asked to complete evaluations on a daily basis and a summary evaluation form at the end of the camp. In addition, in early November a sample selected from camp participants was asked to comment upon what they had learned at the camp that they have been able to use in their teaching. The evaluation forms indicated that camp participants had found the camp of value for several reasons. Among the reasons cited for the success of the camp were the quality of the workshops, usefulness of technologies introduced, manageable number of participants in each workshop, opportunity for increased collaboration between the schools, and the overall structure of the workshop. All but one participant, who was undecided, indicated that they would like continuation of this project. Each participant selected to participate in the November survey listed specific skills and information they had learned at the camp and were currently using in teaching. Several participants asked that the camp be expanded next year.

A major benefit of the camp, in addition to the practicality of what had been learned by the participants, is the good will and collaboration that was established among the participants. This will serve as a catalyst as additional activities are planned under the consortium's implementation grant.

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Faculty Teaching Faculty: A Matter of Trust

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Abstract: The primary aim of the Viewing and Doing Technology (VDT) Project was to situate field-based secondary preservice teachers in a learning environment in which university faculty demonstrated skillful teaching with technology and offered students rich opportunities for visualizing and infusing technology in teaching. This project involved 10 secondary teacher preparation faculty who developed and conducted professional development workshops for each other. Workshops included developing online course materials, creating WebQuests, peer editing with word processing software, developing video cases, creating multimedia course materials, and photo editing. Graduate assistants, two computer science majors, provided technology support. Data collection included email messages, faculty created web pages, observations, and interviews. Results of the data analysis indicated the faculty developed a connected community of learners who worked together to learn new ways to use technology and incorporated what they learned into their teaching.

Infusing technology into classes throughout the teacher preparation program assures that preservice teachers experience how technology can be woven into daily classroom activities (Halpin, 1999). This modeling of technology integration provides a foundation for students as they develop the skills and confidence to use technology in their own classrooms. This requires that teacher preparation faculty know how to use technology to enhance their own teaching. However, teacher preparation faculties oftentimes do not receive the professional development, hardware, software, specialized support, released time, and recognition to develop the technological skills needed to infuse technology into their teaching.

In order for teacher preparation faculty to infuse their teaching with technology, they need professional development opportunities to learn to use technology and to learn to teach with technology. Effective technology staff development requires, among other things, immersion in learning over extended periods of time, active involvement, a community of learners, a focus on the learners' needs, and time for reflection (McKenzie, 1991). Additionally, effective professional development focuses on how to use technology to improve teaching and learning (Cottrell, 1999). The workshop facilitators must take into consideration the concerns and feelings of the participants (Linnell, 1994). Using the cognitive apprenticeship approach in professional development assures that instruction is relevant, focuses on authentic problems, and provides ongoing support after the workshops (Ritchie & Wiburg, 1994).

Just-in-time (JIT) direct instruction is one means of providing ongoing support. JIT is assistance that is provided when it is needed, is specific to the learners' needs, and is usually under the learners' control (Willis, Stephens, & Matthew, 1996). Further, JIT direct instruction teaches the learners a basic skill needed to solve a current problem and enables them to move beyond an impasse. This personal support for learners is crucial for faculty members as they learn to use technology. Immediate, specific technology support can be provided by students who know how to use technology and are immediately available to assist faculty members (Gonzales et al., 1999; Hruskocy, Cennamo, Ertmer, & Johnson, 2000; Thompson, Schmidt, & Hadjiyianni, 1995).

Learning to use technology and to infuse it into the curriculum in meaningful ways requires ongoing support from a connected community of learners who use technology. A community of learners provides not only the resources and technical support required to use technology but also the confidence to teach with technology (Ginns, McRobbie, & Stein, 1999; Hruskocy et al., 2000). This community of learners may include both students and teachers. Tom Carroll's, Preparing Tomorrow's Teachers to Use Technology (PT3) Program Director at the U. S. Department of Education, vision for teacher professional development includes intergenerational collaborative learning between teachers and students whereby they learn from one another (Sanford, 2000).

Teacher preparation faculty members do not infuse technology in their classes in part because they lack professional development opportunities, proper equipment, and support. This research sought to determine if providing professional development workshops, proper equipment and a supportive community of learners would create a technology rich learning environment for preservice teachers. Hence, the Viewing and Doing Technology (VDT) Project was conceived as a way to facilitate this process by enrolling select faculty at Southwest Texas State University (SWT) in workshops that would help them learn and practice ways to use technology effectively. The ultimate aim of VDT was to situate field-based secondary preservice teachers in a learning environment in which university faculty demonstrate skillful teaching with technology and provide students with rich opportunities for visualizing and infusing technology in their teaching.

Methodology

Participants

Participants in this study were 10 secondary teacher preparation faculty, 4 males and 6 females, teaching in professional development schools. Faculty members had been teaching at the university level from 6 months to 25 years. They ranged in age from 35 years to over 55 years. All participants except one reported having a home computer that they used on a daily basis, checking their email daily, and using the Internet daily. These faculty members taught field-based courses at four area high schools and one middle school. Because they spend 15-20 hours at their perspective school sites, they had few opportunities to learn and practice new technologies as well as limited time to work together to develop into a community of learners. The establishment of a "Visions Center" at one of the field-based sites served as a model for using current technology and developing constructivist-teaching practices. Participants received a stipend for participating in the workshops.

Procedure

The faculty members engaged in a faculty-teaching-faculty series of workshops. That is, they developed and conducted professional development workshops for each other. The five-hour workshops were held on Fridays during the course of the academic year and were led by one of the 10 faculty members with expertise in a particular area. Prior to the workshops, faculty members communicated by email to discuss the workshops. These email communications provided the workshop facilitator information about the concerns and expectations of the participants and assured that the workshops would meet the needs of the participants. Some faculty members placed workshop materials on-line prior to their workshops. Content of the seven faculty workshops included developing online course materials, creating WebQuests, peer editing with word processing software, developing and using video cases, creating multimedia course materials, and photo editing.

Workshop facilitators provided direct instruction, which included not only the necessary technological skills but also information and examples demonstrating how the technology was incorporated in the facilitator's university classes. Participants were then provided opportunities for guided practice to assure that they not only learned to use the technology but also understood how the technology could be adapted to their own classrooms. Two graduate assistants, computer science majors, assisted the faculty members during the workshops and were also available to assist faculty in their offices and in their field-based placements at area high schools.

One workshop was presented in the "Visions Center;" the others were conducted at a campus computer lab. The "Visions Center" provided faculty with access to the latest technology and was located on site at one of the local high schools where two members of the faculty were field-based. The campus computer lab provided a familiar environment for the faculty members and for some participants, workshops conducted here required less travel time. Coffee, soft drinks, and other refreshments were available to the participants throughout the day. At the start of the workshops lunch orders were placed and lunch was delivered to the site.

Results

Data collection included email messages, faculty and VDT project web pages, observations, and interviews with the faculty members and graduate assistants. Content analysis was used to determine common themes and patterns across the data sources.

The adoption of technology is a complex, nonlinear process that develops over time (Wesley & Franks, 1996) and faculty members involved in this project were cognizant of this fact. They understood that learning to infuse technology in their teacher preparation classes required a long-term commitment, would at times be frustrating, and would require that they become a connected community of learners who would learn together and teach each other. When asked about the impact of VDT on their teaching, faculty members reported that it was a good foundation for the next step. They were looking forward to more technology professional development and receiving additional equipment to use at their field-based schools. Faculty wanted input as to the what technology was to be purchased so they could have a choice in computer platforms and to be able to get what they wanted to use in their classes. Faculty members realized that integrating technology into their curriculum required a long-term commitment and would require them to continually learn new ways to use technology in their teaching.

Workshop topics were selected based on the participants' needs and focused on the effective use of technology to enhance teaching and learning. Participants were actively involved in the workshops and in the adaptation of the skills learned to their own classroom teaching. Faculty members reported that they thought it important that they were able to decide on the workshop topics themselves, as it was important that the workshops be specific to their needs. Not included in the workshops was a session on *PowerPoint*, because as one faculty member noted, "Everyone is using *PowerPoint*." Additionally, it was noted that using *PowerPoint* does not change instruction; professors just put their notes in PowerPoint and continue to lecture to students. Faculty members understood that to effectively use technology in their teaching would require them to change the way they taught.

A connected community of learners was formed as the participants made their workshop materials available on the web, communicated by email, and assisted one another as they encountered problems. Links to workshop materials were available from either the VDT web site or from the workshop instructor's homepage prior to the workshops. Participants were encouraged to preview the materials to assure that they had some understanding of the concepts to be presented and that the content of the workshop met their expectations. For example, prior to the workshop on web forms and web tests a web page was placed on-line with links to some existing web based forms for the participants to preview and the pretest for the workshop. Participants were asked to think about how they could use web forms in their teaching and were asked to bring to the workshop a form or test they would like to deliver via the web.

The faculty instructor for the *PhotoShop* workshop challenged the participants to construct the rationale and the design for the workshop to assure that it would be meaningful to them. To encourage the participants to think about what they wanted in the workshop, he posed a series of questions to them via email. Just as faculty members communicated with one another via email they also used email to communicate with their students. Faculty members commented that students have more access to email than previously and require students to use it for communicating with the professor and with one another.

Faculty members relied on one another for technical support. One faculty member commented that when helping another faculty member with a computer problem it is important to help them develop troubleshooting skills to enable them to solve future problems. This type of assistance empowers the faculty member with the skills to think through future problems and possibly solve them on their own. When teaching faculty about computers this faculty member introduces them to the control panel where they can make simple changes and teaches them about extension conflicts. He also cautions them about what leave alone.

Workshop facilitators were colleagues who took into consideration the levels of expertise of the participants and knew the unique problems faced by faculty members teaching in professional development schools, which assured that the material presented was relevant. Workshops included direct instruction in necessary skills, guided practice with written directions, and opportunities to work together to explore and create materials for use in their classrooms. The presentations were focused, yet relaxed and participant input was encouraged. The facilitator, the graduate assistants, and any participants who were somewhat familiar with the content of the workshop provided assistance.

Time for reflection was an important component of each workshop. Prior to each workshop, participants completed a pretest on the material to be covered in the workshop either online before coming to the workshop or on paper prior to the start of the workshop. At the beginning of the workshop faculty members talked about their expectations for the workshop and reflected on the email messages they had sent to one another about the workshop. They discussed how they thought the skills to be learned in the workshop could be used to enhance their teaching and possible ways to share their new knowledge with their students. As participants worked they shared comments back and forth on how they could use what they were learning as well as concerns about possible problems in using their new skills in their teaching. At the end of the workshop participants completed a posttest on what they had learned. Answers to the questions were discussed and participants reflected on what they had learned and how it could be used by their students. Workshops concluded with a brief discussion of the content and expectations for the next workshop.

Ongoing support for the faculty members was provided by graduate assistants who worked with the faculty in their offices and in their field-based classrooms. The graduate assistants were computer science majors, who provided technical assistance to the faculty and taught them to use various pieces of hardware, such as scanners and digital cameras, and software, such as *PageMill* and *FrontPage*. Their duties also included setting up new hardware as it arrived and loading software on computers. During interviews they commented on teaching the faculty to create web pages. The students preferred to use HTML for creating web pages, but learned *FrontPage* and *PageMill* in order to teach the faculty members how to their own create web pages. They realized that the faculty members would not be able to easily learn to create and maintain their own web pages if required to use HTML. They were pleased that the faculty members could now create and maintain their own web pages. While the graduate assistants were originally dismayed at how little the faculty members knew about computers when compared to their own knowledge of computers, they took great pride in what they had been able to teach the faculty members. They realized that the faculty members were willing and eager to learn about technology. Observations were made of the assistants teaching faculty members to download photographs from a digital camera. The assistants patiently explained the procedure and then allowed the professors to attempt the process on their own. The assistants hovered close by to guide the professors and to answer any questions they had about the process. The assistants were also available to support other university professors not involved in the VDT project. The just-in-time instruction they afforded faculty members assured that as problems and concerns arose they were quickly addressed.

When asked to provide examples of how they were incorporating what they learned in VDT workshops into their teaching, the participants were eager to share their students' work. One professor had students turn their projects into web pages, which were placed on-line to be shared with their classmates. She commented that students "loved" being able to see their projects on-line. Another professor created a *HyperStudio* stack on theories of adolescent behavior. Then, the students added cards to the stack that reflected a practical application of the theory. Their stacks were saved on zip disks, put on the college computer network, and shared with the other students in the class. Another professor shared how he had used *Inspiration* software to create a map of his course materials on moral development. Professors also cited the usefulness of learning to create web pages and creating web pages for their professional development sites. Not only were the university students using the web pages to check for their assignments, but so were the cooperating teachers, who wanted to know what they should be expecting from the students. Some professors stated that they had not been able to use all of the things they learned in the workshops because they did not have access to the equipment and software at their professional development schools. The lack of time to incorporate all they had learned was also noted.

Faculty members commented that each year the students they teach are coming to them more computer savvy than the last group and that students manage to find access to technology when it is required for their courses. They also recognize that as professors it is their responsibility to know about software and be able to guide students as they learn to use various pieces of software in their teaching. They keep examples of past students' work to show their present students possible ways to use different pieces of software in their teaching.

Conclusions

Faculty members and graduate assistants formed a connected community of learners who provided each other the technical support and the confidence to teach with technology assuring that their preservice teachers learn in a technology rich environment for visualizing and infusing technology in their teaching. This connected community of learners challenged each other to use technology and supported each other as they worked to use technology to improve teaching and learning. The VDT project provided participants opportunities to immerse themselves in learning to use technology relevant to their needs over an extended period of time, through active hands-on workshops followed by ongoing support provided by other participants and graduate assistants. Additionally, VDT workshops allowed participants time to share and reflect as they learned to infuse technology into their teaching. The workshops provided faculty members time to visit and share success stories and challenges encountered in their field-based teaching.

Faculty members found the workshops relevant to their teaching and cited examples of how they were able to incorporate what they learned into their classes. Some noted that the lack of resources at their professional development sites prevented them from incorporating all that they had learned. However, not being able to immediately implement something in their teaching did not affect their enthusiasm for learning about technology. One indication of the success of this project is that once the funding ended faculty members decided to continue their collaboration in order to further develop their technology expertise.

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Preparing Pre-service Teachers for Integrating Technology into Science Instruction: a PT3 Project

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Introduction

This paper reports on the first year of a Preparing Tomorrow's Teachers to use Technology Capacity Grant Project designed to provide preservice teachers greater exposure to the instructional uses of technology (Maddux, 1984). Skills in the application of communication, presentations, microworlds (Jonassen, 1996) and CLE technologies are explored to bring to the classroom real-life examples (Cognition and Technology Group at Vanderbilt, 1990) and situations that provide the contextual framework so important to learning (Brown, Collins, and Duguid, 1989).
Goals for the project include:

- curriculum revision for college science methods courses to integrate more use of technology,
- integrating similar technology into both college and public school instruction,
- providing technology training and pedagogical mentoring for college teacher education faculty and participating public school teachers,
- exposing students and faculty at both the college and public school to current software and hardware offerings,
- providing leadership for technology rich instructional unit development, and
- enhanced experiences for pre-service teachers in teaching with technology in the classroom.

The participants in the consortium consisted of three professors at Westminster College, and two science and three math instructors, the technology specialist, and the principal at Bryant Intermediate School. This paper will report on the attitudes, experiences, and techniques of the science methods professor and the project administrator at Westminster College (who are co-authors of this paper), the two science instructors at Bryant Intermediate School, and elementary and secondary pre-service teachers.

Background Narrative

The overarching plan for the project involved the following timeline. During August participants met to discuss individual broad goals, and to discuss technology needs and skills to be developed before curriculum revisions. A final timetable of meeting dates, workshops, and assignment due dates was established. September brought the initial workshop to help develop skills for all consortium partners in technology applications integrated with instructional and learning methods. Participants explored issues of computer anxiety in students (Maurer and Simonson, 1994), factors contributing to successfully evaluating

software, computer simulations in the classroom (Jonassen, 1996), and principles of instructional design (West, Farmer, and Wolff, 1991).

Through October to December participants met as a consortium, with the project director facilitating meetings, every other week for about three hours. As participants developed their curriculum, changes were reviewed with suggestions made as to how to further integrate technology.

As this period unrolled participant's roles evolved. The project director administered the grant and scheduled and provided technical assistance and teaching with technology expertise. Westminster science faculty became mentors for school participants, and school participants either bought into the project and found ways to challenge themselves in their curriculum revision or did not. Each meeting was conducted in a manner conducive to free and open democratic discussion and input. This was a key feature of the design of the grant so that the public school teachers who became consortium partners would feel, and be, in a true partnership. As this period progressed it was planned that students from the college who were enrolled in the fall educational technology course would demonstrate the use of educational technology instructional strategies to the consortium members to help them make informed decisions about the curriculum change process. In early December the consortium met to decide on conferences that would further enable the learning process and to plan technology purchases funded by the grant. Purchasing decisions were made by common open vote with an attempt at equality of access to the purchases by all participants. Before Christmas the developed unit plans and curriculum changes were reviewed by all and technology purchases began. Presenting and teaching these enriched units was planned for specific days in the next year so that preservice teachers could attend. The goal here being preservice teacher exposure to classrooms where real teachers were teaching real technology enriched lessons.

From late January to May participants taught their revised curriculum with other consortium members and/or preservice teachers in attendance. The goal was then to deconstruct the curriculum and revise as necessary. These revisions would then become models from which to draw expertise for further more extensive revisions the following year with even more technologies learned, and integrated into practice.

Method

All partners in the consortium were required to keep journals detailing their experiences, thoughts, and actions as they engaged in the project. Additionally participants were surveyed and interviewed at the beginning and end of the school year about their inclinations and abilities to use technology, and to use it in teaching. The interviews were audiotaped and transcribed for analysis. Additionally, the project's outside evaluator (a co-author of this paper) conducted classroom observations in methods courses and intermediate school classrooms and informal interviews with consortium participants. Data from these sources provides the basis for formal evaluation of the effectiveness of the grant, and for this paper.

Narrative

Between October and December 1999, the consortium met regularly to revise curriculum. Our hope, both at the college and intermediate school level, was to infuse meaningful technology into similar units of study. Through our collaborative meetings in late 1999, we found that the science methods professor and the science instructors at Bryant were planning units of study focusing on various ecosystems. This resulted in significant changes in our teaching practices. In the science methods course, pre-service teachers set up experiments that addressed questions concerning animal and bacteria life on the Great Salt Lake. In order to conduct the experiments, the pre-service teachers used an array of technologies including field microscopes, conductivity meters, temperature probes, water testing kits, video microscopes, and several web sites.

Each of the pre-service teachers worked with the technologies during the science methods class sessions; however, the three pre-service teachers who had field placements at Bryant were also able to assist the science instructors there when the same technologies were introduced in their units on ecosystems. Eventually, two of the pre-service teachers helped facilitate "stations" on a culminating eighth grade field trip to the Great Salt Lake, to study ecosystems. At each station the students used temperature probes and conductivity meters to ascertain the temperature and salt concentration of water and soil in the surrounding area. Additionally, the students used the water testing kits to gather data on the pH of the

water and soil at each station. The field microscopes were used to observe salt crystals, brine shrimp and algae. At a later time, the students videotaped these organisms with the video-microscopes.

All pre-service teachers in the secondary methods course were required to create a lesson on the Great Salt Lake using many of these technologies for their final assignment. These pre-service teachers were then able to experience teaching with technology when 70 eighth grade students came to Westminster College to participate in the pre-service teachers' lessons.

During this period from January through May technology purchases were made according to our plans and by a collaborative decision making process. Participants attended conferences partly funded by the grant and where necessary substitute teachers were provided to allow further workshops to take place. It was also during this period problems began to arise. Though the planning for the project called for a very democratic partnership it became evident teacher participants struggled with this notion of equality. With their years of experience advising teachers to defer to authority, whether it is real, or assumed through presumed superior knowledge, the teachers were unable to maintain a democratic partnership. In instances of planning curricular change the teacher participants deferred continually to their college peers. They were often late to meetings sometimes expressing a subservient truculence to perceived authority. As this continued science faculty and the Project Director did in fact assume more authority to get the project completed. This became an issue as the year came to a close and the teachers were largely left on their own to deconstruct and revise their new curriculum. Where college faculty naturally assumed this task as part of the grant project agreement, perhaps because such acts are a regular part of their profession, the teachers did not push forward with revisions without heavy encouragement to do so from the project director.

Another issue revolved around issues of control dictated by the school district of which Bryant is a part. When Westminster donated ten Pentium computers to Bryant the district would not support the machines by providing technical assistance. The machines were examined by a technician who claimed they were stripped and needed hard drives when in fact only the operating system needed to be loaded. To overcome this problem one teacher, perhaps used to handling such issues, with the full support of the other teachers, did the work herself. This was done surrepticiously so not to offend district technology personnel. Effectively, while technology shortages existed at the school, the district would not supply support for donated hardware nor provide timely support for district approved hardware purchases. Though the district was supposed to be an active partner of support for the grant, they provided very limited support for their teachers involved in the grant. Further problems arose through the billing practices of the district. Routinely it took the district several months after the receipt of purchased items to bill the grant. Though efforts were made to correct this problem, several months after the grant expired the district forwarded bills totaling in the thousands for hardware purchased ten months earlier.

Results and Implications

The opportunity to participate in a coordinated technology rich experience between their methods course and their field placement, allowed pre-service teachers to focus on the issues of teaching with technology rather than on just becoming familiar with the technology. Pre-service teachers expressed an increased awareness of the parameters involved in using and teaching with technology. They found the experience of first learning with and then teaching with the same technologies to be an important influence on their thinking about integrating technology into the curriculum. This was reflected in their post interviews and surveys, as well as in the final units of instruction they created and taught.

This said there were problems. Scheduling the preservice teachers to be in the participant teachers at times when the technology enriched lessons were taught proved difficult. An issue evolved around the selection of a faculty member to supervise these students as they visited classrooms. Unfortunately the faculty member with this charge had a very limited understanding of the value of technology for teaching and learning. She encouraged the students to be very critical in their observations of classroom practice. This negativity resulted in a number of preservice teachers jaundicing their view of technology as useful to teaching and learning. A key issue here is to be sure when engaged in a collaborative project, such as this, that both formal and informal participants buy into the goals of the project. A single negative perspective can induce problems of lasting longevity for new teachers, and influence the whole nature of a collaborative experience in an unwanted direction. More and better exposure to the planning involved in making the classroom experience a rich learning milieu for both participating preservice teachers and attendant faculty might have reduced this problem. For the following year plans were laid for the project

director to work closely with students and faculty intent on visiting these technology rich sites. It is hoped that by making the students part of the curriculum design experiment they will view the project as theirs and thus view the classroom teacher's efforts in a more positive light.

Trying to provide a truly democratic partnership through collaboration also proved problematic. While levels of previous experience with technology varied, initial enthusiasm for teaching with technology united instructors at the college and intermediate school as they began this project. These instructors were convinced that integrating technology into their curricula would enhance learning experiences for their students, i.e. the pre-service teachers and the 8th graders. However, what was intended to be a democratic partnership with all members of the consortium participating equally in curriculum design and development, and in mentoring pre-service teachers, evolved into something less. As stated earlier, as the school year progressed, collaboration diminished. To overcome this problem the consortium chose to put in place a video conferencing system to enhance communication and perhaps to view into each other's classrooms. Through sharing successes and trials a bond of common ownership for the process of teaching with technology will be attempted.

Another issue here is the role of the school principal. Through the year of the grant project the principal remained a peripheral player. Through the request of preservice and teacher participants the principal and other key personnel in the school and from the college will be asked to make a much stronger effort to watch teachers and faculty at work teaching with technology. Beside the "feel good" gain of being in the spotlight, teachers and faculty expect this move to make their efforts on behalf of the school, the college, or future teachers, recognized and valued. There will be a major effort to this end in future years of the consortium.

Another significant issue for the preservice teachers was the minimal measure of technology support from the district for the participants. It was widely understood that hardware and software purchase and support for the intermediate schoolteachers was not timely or sufficient. This could have been remedied through increased guidance and effort from the technology support personnel from both the college and school district. Preservice students questioned the level of support they could reasonably expect to receive when they became practicing teachers. After all, why learn to teach with technology, spending hours revisiting traditional curriculum, if district technology support fails to permit timely use of hardware. A further issue is that the preservice teachers observed that participant teachers felt a lack of preparation for using and teaching with the technology. This will improve as the instructors at both schools continue with the project. Finally, Bryant teachers did not fully understand their expected role in mentoring pre-service teachers, and college based partners were not sufficiently involved in the actual classroom experiences of the pre-service teachers at Bryant. Careful planning should overcome these issues.

What next?

First year jitters associated with using initially unfamiliar technology, teaching a newly revised curriculum, and forging a partnership between college and public school instructors is now behind the partners in this project. The participants now intend to develop more curricular units that will provide pre-service teachers more opportunities to experience and participate in teaching with a greater variety of technologies. They also will be adding more public school teachers to their partnership in order to provide exposure for more pre-service teachers to this coordinated experience in learning and teaching with technology.

This growth in project team members, and their locations in additional public school sites, creates new challenges in administration and communication. The consortium has stepped up their communication technology capability to address the potential problems in coordinating efforts between members of a larger group. An issue in the year of this grant was that the Project Director, was the administrator, workshop leader, curriculum designer, peacemaker, purchaser, and arbitrator, without decrease in faculty load. For the coming year an Assistant Director as well as a technician has been hired as the project continues as an Implementation grant. Also, decreasing required faculty load has increased project administrator involvement time. Additionally the project administrator's responsibilities have also shifted toward more specific direction of the project activities.

It is this year when the outcomes to the consortium project will affect preservice teachers more broadly. Faculty who participated in the consortium last year is being joined by others with expertise in language arts and creative arts in revising their curriculum to a technology rich standard. Incoming faculty

has been apprised of the trials and successes of last year's efforts and are reaping the benefits of what we now refer to as our pilot year. Along with this the educational technology course that all preservice teachers must take to complete and earn their teaching license is under full revision to include the lessons learned by the consortium about teaching with technology. This means more in-depth exposure to video-conferencing as a communication tool, greater emphasis upon the web as a source of data for lesson development, and most importantly a shift in perspective from teaching in a traditional fashion with technology replacing a text or the chalkboard, to teaching with technology as a metaphor for teaching as a curriculum designer. This change may positively akter many teachers' views of continuing in their profession. If so, this approach may indeed have consequences upon teacher socialization and teacher desire to continue to practice.

Project goals for years subsequent to this reflect the findings ground out through careful planning, happy circumstance, and sometimes unrealistic expectations. More data is needed to ascertain just how effective this project becomes in providing preservice teachers the knowledge, skills, and desire to use technology in their practices. To this end Westminster College has dedicated time and faculty to follow teacher candidates as they begin their practice. Through personal contact, further mentoring, and surveys details of the role of technology in teaching for these graduates will emerge, be presented and published.

Further research will focus on the working partnerships between college and public school instructors that develop as a result of this project. Also, findings from the initial year of the project will be used to guide further research into the effects of specific aspects of the project on pre-service teachers' inclinations and abilities to integrate technology into their teaching, as well as to how this process affects their inclination to continue as teachers.

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Faculty Mini-Grants: A Key Piece of our PT3 Puzzle

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Abstract: The mini-grant concept, used at many universities, was identified as a "best practice" in a study of teacher education programs deemed exemplary in their integration of technology (Strudler & Wetzel, 1999). It is designed to address the obstacle identified by faculty as the biggest impediment to technology integration--*time for professional development*. Planned in collaboration with UNLV's Teaching and Learning Center, our mini-grant program provides faculty time outside of their normal work schedule to gain new skills and plan and develop technology-enhanced learning activities for their classes. Ten mini-grants were awarded last summer as part of our PT3 Capacity-building grant. Now, our Implementation grant includes 36 mini-grants per year for three years--24 within the College of Education and 12 to faculty in other colleges across campus. Overall, we feel that the mini-grants offer a wonderful "next step" as a follow-up to the faculty workshops that we've offered. This paper will document the process and outcomes of our mini-grant program to date. For more information and examples of faculty projects please see: http://www.unlv.edu/projects/THREAD/.

Introduction

Project THREAD, funded through a PT3 Implementation grant at the University of Nevada, Las Vegas (UNLV), was designed to make technology infusion a systemic part of preservice teacher education. One key ingredient necessary to accomplish this goal involves a range of professional development activities for UNLV faculty. In addition to providing a series of workshops and follow-up support, a mini-grant program has been initiated to provide faculty with the time and support necessary to integrate technology into courses in significant ways. This paper will describe our efforts to implement this mini-grant program, document outcomes achieved thus far, and discuss future directions for the initiative.

Background

A needs assessment was conducted in fall, 1999 that documented the attitudes towards technology by UNLV College of Education (COE) faculty and their use of technology in teaching. Virtually all faculty rated technology in teacher education as "very important" (68%) or "somewhat important" (30%). Despite this finding, survey results indicate that faculty use of technology in teaching is limited. When asked what factors restrict or constrain their use of technology in teaching, 63% of the COE faculty cited *time for professional development.* This finding is consistent with the literature pertaining to impediments to technology integration in teacher education (Strudler & Wetzel, 1999). By and large, UNLV College of Education faculty have stated in a series of planning meetings that with the provision of time, professional development, access to technology resources, and follow-up support, they will commit to moving forward with technology integration in the COE.

Time for Professional Development

The literature on technology implementation in schools is unequivocal--professional development is critical to achieve widespread technology integration. While workshops and follow-up support are key components of our professional development program, they do not directly address the number one need identified by faculty--*time.* Whereas in early technology integration efforts access to technology resources was cited as the major obstacle, time has emerged for many educators as the most pervasive impediment (U.S. Congress, 1995). To address this need we are implementing a *mini-grant* program that provides faculty time outside of their normal work schedule to gain new skills and plan and develop technology-enhanced learning activities for their classes.

About the Mini-grants

This mini-grant concept, used at many universities, was identified as a "best practice" in a study of teacher education programs deemed exemplary in their integration of technology (Strudler & Wetzel, 1999). Planned in collaboration with UNLV's Teaching and Learning Center, our mini-grant program provides a $1500 stipend for selected applicants to work on campus when school is not in session--during winter break or during the summer. Ten mini-grants were awarded last summer as part of our PT3 Capacity-building grant. Now, our Implementation grant includes 36 mini-grants per year--24 within the College of Education and 12 to faculty in other colleges across campus. Contingent upon continued funding, the mini-grant program is planned through the 2002-2003 school year.

To obtain a mini-grant faculty must submit proposals that identify how they plan to enhance components of their courses with technology. A review committee composed of project staff and members of Project THREAD's Advisory Board review the proposals. Criteria for rating the first round of proposals were based on the quantity and quality of learning for the faculty involved in the project, the degree to which the proposal meets specified ISTE/NETS for Teachers' standards and addresses gaps in preservice teachers' learning experiences, and the expected impact the mini-grant will have on preservice teachers. To foster integration in coursework and throughout programs, faculty may submit collaborative mini-grant proposals. Support for the mini-grants is being provided by Project THREAD staff as well as by UNLV's Teaching and Learning Center.

Results

Our first call for mini-grants was posted in Spring 2000 and was promoted in the various Project THREAD workshops. We received proposals from 15 faculty, 10 of which were accepted based on the criteria discussed above. In a few instances, before accepting the proposals, Project THREAD staff "negotiated" with the applicants and suggested revisions that would help the proposals better meet the project's goals. In the case of applicants whose proposals were not accepted, feedback was given and applicants were encouraged to revise and resubmit their proposals during future iterations of the mini-grant program.

Applicants whose proposals were accepted were sent an agreement form that specified the expectations for the award. Upon signing that form, participants were given an initial payment of $500 in the form of stipends or equipment. The remaining $1000 was held pending completion of the proposed activities. Documentation of completion included a written lesson plan, revised syllabus, and a brief presentation to members of the Project THREAD staff. The presentations, which were approximately 20-30 minutes long, gave recipients the opportunity to show and discuss what they had accomplished as a result of the mini-grant. Project THEAD staff also had the opportunity to ask faculty about their experiences as mini-grant recipients.

Descriptions of each of the mini-grants can be found at: http://www.unlv.edu/projects/THREAD/mg/rapss00.html. At the bottom of each of the mini-grant pages is also a detailed evaluation of the syllabus that was revised as a result of the project. In addition, the requests for proposals are available in the Mini-grant section of the Project THREAD web site: http://www.unlv.edu/projects/THREAD/.

Lessons Learned

The actual implementation of the mini-grant program presented a myriad of challenges for recipients and project staff. In some instances, the professional development needs pertaining to the proposals took project staff to the edge of their experience and expertise. This was especially true in the case of digital video projects. In addition, we experienced our share of challenges in procuring some of the equipment and getting it all installed and functioning in a timely way.

We are currently completing in-depth interviews with the mini-grant recipients to learn more about their experiences with the mini-grants and how they may have affected faculty's knowledge, skills, and dispositions. Results of these interviews will be reported at our SITE 2001 presentation.

Our second call for mini-grants incorporated some revisions based on our experiences. For one thing, we opted not to include equipment procurement as part of the program. Thus, while we will continue to consult with faculty about what software or equipment may contribute to their proposals, faculty will be responsible for purchasing the materials themselves with the stipends that they receive. We anticipate that this change will free up time for the Project Coordinator to focus on her main role in the mini-grant--professional development.

Other enhancements of the mini-grant process include clearer expectations for program priorities. For one thing, the revised RFP requires faculty to complete a planning form that asks them to identify what National Educational Technology Standards for Teachers are addressed in their courses. Since the mini-grants have proven to be a viable incentive for faculty, we are trying to be sure that we take advantage of this "carrot" to support the implementation of some of the less desirable elements of our project—namely, being systematic in our planning. Other program priorities encouraged in the RFP include projects that: (a) are outcomes-based, model technology integration for preservice teachers, and expand students' opportunities for active learning; (b) meet goals established by faculty the curricular areas; (c) are designed to affect systemic change—e.g., projects with potential to impact *multiple sections* of a course or programmatic changes; and (d) use some of the new technology resources of the College of Education including our portable, wireless lab of I-Books that were purchased for the project.

Spreading the Word

One strategy that we've used to "spread the word" has been to highlight the accomplishments of mini-grant recipients at College faculty meetings. In two successive meetings this fall, we've arranged for short presentations (15-20 minutes each) in which faculty demonstrate what they've done and talk about their experiences. We believe that our recent mini-grant recipients are serving as our best ambassadors and doing an excellent job of spreading their enthusiasm. Since many of the presenters are not seen as *techies*, they serve to dispel the notion that our professional development activities are geared only those who are technologically inclined. Following these faculty presentations, we've received many questions and inquiries from faculty about future mini-grant offerings.

Overall, we are thrilled with the results of the mini-grants thus far. We believe that they offer a wonderful "next step" as a follow-up to the many workshops that we've offered. While workshops can be very effective in helping faculty establish a vision for what they might do with technology in their classes, a substantial investment of *time* is necessary for faculty to expand their skills and plan changes in their courses. When compared to other professional development models, we believe that the mini-grants provide a cost-effective way to carve out time for faculty to extend their work with technology in substantial ways.

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Integrating Technology into the K-6 Classroom

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The United States Department of Education has made clear the growing need for well-prepared, technology-proficient educators. The need is greatest among low-income communities, rural areas, minority groups and areas characteristic of what is now known as the "digital divide." The situation for Valley City State University (VCSU) and its partners within the Sheyenne Valley fits this description in every way.

The strategic theme at Valley City State University the last eight years has been dramatic change to help meet the needs of students and the state. Such a change began in 1996, when all students and faculty gained access to full-time use of a laptop computer, with networked facilities and renovated classrooms to promote maximum use of the computers as tools for learning. VCSU was the second four-year university in the nation to take this initiative. More importantly, VCSU was the first teacher preparation institution in the United States to implement a universal laptop initiative. With the administrative structure in place, the learning tools in use, and faculty with over four years of laptop experience in the classroom, we have moved to the next educational step—a collaborative experience with K-6 schools to better meet the needs of our preservice teachers.

To respond to this need to produce technology proficient teachers, the VCSU Elementary Education program has formed a partnership with six other educational entities to strengthen and improve learning with technology and to ensure that there is continuity between the VCSU Elementary Education technology requirements and K-6 needs. To help achieve this continuity, the VCSU Elementary Education Department applied for and received PT^3 implementation grant from the U.S. Department of Education.

One of the main goals of the grant is to provide opportunities for VCSU Elementary Education faculty, preservice teachers and inservice teachers from the consortium to work together to integrate technology into their courses and to create a learning community among themselves for the purpose of using technology to improve learning and develop complex reasoning and problem solving skills.

Cooperating teachers representing the various consortium school buildings are collaborating with VCSU faculty and preservice students to restructure learning experiences in their classrooms that reflect current best practices for using instructional technology strategies and tools. Curriculum teams begin by

choosing one unit of study. They develop and organize units that focus on cross-discipline, student-centered projects that use technology to enhance and expand student experiences. These restructured units are being put in place and working to change the way education is delivered not only in the K-6 consortium classrooms, but also in the practicum and student teaching experiences of the preservice teachers. Maximum use of web and communication technologies is also in the process of being implemented.

The teams consist of one K-6 teacher, at least one university teacher, VCSU students and a Center for Innovation and Instruction (CII) advisor. The teams select specific projects to work on and develop. The teams also develop a formative and summative evaluation process that takes place throughout the projects. The design of the evaluation process is project specific. The projects are implemented and evaluated in the classroom and are published on the grant web site (http://www.vcsu.nodak.edu/projects/pt3_grant/).

Teams of VCSU and K-6 faculty will also be participating together in an intensive three-day session focusing on technology integration and collaborative project building in the classroom. The session will move them through levels of awareness, application, integration and assessment. This will expose the educators to a combination of technology use and integration methods and ideas, including instructional strategies for complex reasoning and problem solving, telecommunication resources, multimedia hardware and software, cross-discipline and project-based content, and authentic assessment.

Elementary Education students will also create material specified by K-6 teachers to be used in the collaborative projects and other classroom activities. These products will include multimedia, CD-ROM, web pages, digital portfolios, and other information technology products. Each product will follow a real world production model: planning, producing, implementing, evaluating (both formative and summative) and revising.

VCSU faculty will develop on-line, asynchronous support material using courseware blackboard (Bb). The modules will be available to preservice and inservice teachers to help them improve learning. For example, a language arts teacher may produce a module on the writing process as a problem solving strategy or the educational technology teacher may develop a module on a Bb to develop a complex reasoning activity.

The Elementary Education faculty will undergo extensive training on the design process for course software for developing on-line methods distance education modules. Faculty will be provided with release time or other appropriate incentives to develop the modules. Each module will be pilot tested with a sample group, evaluated, revised and published on the grant web site (http://www.vcsu.nodak.edu/projects/pt3_grant/).

Another goal that we are working toward is directed specifically toward the preservice teacher. We would like each Elementary Education graduate to be able to use technology to help their students improve learning by developing complex reasoning and problem solving skills. To achieve these goals the following objectives have been established.

1. The consortium partners will compile a web-based, fully accessible annotated research base consisting of current successful practices for developing complex reasoning and problem solving skills in collaborative and non-collaborative environments on line and off line. University faculty, K-6 faculty, VCSU students, K-6 students, and the CII will be involved in the research and assessments. The software evaluation process will use a standard evaluation form from CII. The evaluation will also include a descriptive tool for evaluating computer-based instruction. The research base will be available on the grant web site. The research base will be used to inform all the grant projects.

2. Faculty will integrate complex reasoning and problem solving projects into their courses. Students in their regular coursework must be engaged in higher order thinking skills in order to develop their own projects. University faculty must be models for the students and their course assignments must engage students in higher order thinking skills. Projects created in this integrated curriculum will require students to apply the university's abilities to more complex problems (http://www.vcsu.nodak.edu/offices/titleiii/guide/cdport.htm).

3. Students will design and develop their own projects to demonstrate using technology in teaching complex reasoning and problem solving skills. These projects will be designed to help the preservice teacher to become more effective and efficient in their teaching with technology. Students will use a process based on the following steps.

a. determine goals and objectives
b. identify potential projects
c. select projects to be developed

d. develop formative and summative evaluation process
e. select products from the research base to use with project
f. develop project
g. implement project
h. evaluate and revise
i. publish on web site

The success of the PT^3 grant is a reflection of the direction Valley City State University has been moving the past eight years. VCSU has been a national leader in instructional technologies and the resources available at VCSU ensure that successful efforts will be continued and the university will be an example for others to follow.

Furthermore, *Technology and the New Professional Teacher: Preparing for the 21st Century Classroom*, a report of an NCATE Task Force on Technology and Teacher Education, recognizes and underscores the influence that the VCSU teacher education program and its faculty members exert at the national level. Referencing the report, Arthur Wise, President of NCATE, sent VCSU President Ellen Earle Chaffee a letter dated September 11, 1997, that states, in part:

> The report derives its credibility from the expertise of its members and their selection of exemplary practices to highlight. The task force cited a project at your institution as a case illustration. Your selection makes clear that you are at the cutting edge of teacher preparation practice. Your inclusion in our report should extend your influence and help to change the norms of practice.

Pre-service Teacher Responses to the Restructuring of the Traditional Educational Computing Course

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Abstract: The primary focus of this paper is the perceptions of currently enrolled students regarding a new course format. Data has been gathered from students currently participating in CUIN 3111, Technology in the Classroom, through a qualitative ethnographic interview process and through the medium of a web-based newsgroup application. Through this data we will understand the perceptions of our pre-service teacher students regarding their experience of the new technology course and will then be able to incorporate any changes necessitated by these observations into designs for future classes in the upcoming Spring semester.

Context

Educators involved with the preparation of new teachers throughout the final decade of the Twentieth Century have repeatedly recognized the need for a strong technology component for pre-service programs. They have experimented with a variety of learning models that integrated technology (e.g., Beichner, 1993; Carr, 1992; Falba et al., 1999; Munday, Windham, & Stamper, 1991; Persky, 1990; Rodriguez, 1996; Smith, Houston, & Robin, 1994; Thompson, Schmidt, & Hadjiyianni, 1995; Willis, 1997). While some successful projects have indeed been celebrated, there is agreement that new teachers are generally not being prepared to effectively integrate technology into their future classrooms (Office of Technology Assessment, 1995; Strudler, Quinn, McKinney, & Jones, 1995; Willis & Mehlinger, 1994). There is agreement on the following inadequacies of the efforts of pre-service programs:

- It is no longer enough to prepare new teachers only with one disconnected technology-in-education course; introductory courses should instead be project-based and meaningful, followed by appropriate modeling and use in content methods courses and field experiences (Handler, 1993; Wetzel, 1993).
- True modeling of how objectives can be accomplished by using technology for instruction is rare in pre-service programs (Bosch & Cardinale, 1993; Office of Technology Assessment, 1995; White, 1994).
- Pre-service teachers want to learn strategies for integrating technology tools into their teaching (Mowrer-Popiel, Pollard, & Pollard, 1992; Oliver, 1994), and expect to use computers in their teaching (Marcinkiewicz & Wittman, 1995) but express their feelings of frustration at their lack of technology proficiency (Francis-Pelton & Pelton, 1996) and a lack of understanding of effective technology use in contemporary classrooms (Balli, Wright, & Foster, 1997).

In response, a standards-based movement has developed which brings a clearer vision to the preparation of pre-service teachers. Teacher education programs across the country must finally acknowledge the long trend of research findings and recommendations in order to design appropriate learning environments that challenge long-standing curriculum structures through the cooperation of all faculty involved with teacher preparation. Without the purposeful creation of collaborative, authentic, and content-focused learning environments in which future teachers are empowered to develop content, pedagogy, and technology strategies concurrently, new technology standards will be meaningless.

Process and Procedures

Our appointment as Technology Fellows for the PT3 grant at the University of Houston began in the Summer of 2000. At the outset, we were charged with responding to the problems described in the preceding paragraph. The development of CUIN 3111, Teaching with Technology, required that we create a course which was standards-based and yet true to constructivist principles, which allowed pre-service teachers to develop their technology skills while accommodating many different levels of technology expertise, and which enabled us to gather input from our students to better structure the course to their needs. The course would also be given meaning by linking it to the content methods courses in which pre-service teachers were concurrently enrolled. Given the number of objectives involved, this commission seemed somewhat daunting at the outset.

Course Design

Prior to Fall 2000, the College of Education at the University of Houston required its undergraduate education majors to enroll in a three-hour course, CUIN 3312, "Information Technology for Young Children." In an effort to fulfill grant objectives, the original one semester course was divided into three one-hour courses spanning three semesters. The elimination of prescribed assignments stands as a major change in the requirements for the newly structured technology course. In the new model, technology assignments support required education course activities, thereby demonstrating through practical applications how technology should be integrated into classrooms. Students are searching out ways to meet

course requirements using technology even when they are not specifically required to do so by their professors. Early student responses indicated that this model fulfilled the intent of the restructuring effort.

> I think that I am finally beginning to understand these high tech computers. Hopefully by the end of this course, I will be able to get an even better understanding than the understanding I have today! I am looking forward to a great semester!! (Hypergroup posting, student, September 18, 2000)

Student enthusiasm for the new course design was apparent almost immediately. The students liked being given the freedom to design their own learning. One way in which we allowed for student input in the design process was through collaborative development of the rubric, the evaluation mechanism used for each of the reflective papers the students submitted.

> ...the majority of you have been exposed to the standards and the rubric development process. I'd be really interested to know your honest opinions on both. Do you think you would develop rubrics in conjunction with your students? As a teacher it can be a really scary process because you never know what your students are going to come up with. We should have a working prototype of the rubric to show you by next class and you should definitely see the influence of your ideas within it. (Hypergroup posting, tech fellow, September 8, 2000)

As instructors, we felt that we had achieved the initial goals that we had set forth at the outset of this experience. The structure had been established; it was now essential to record student responses, both positive and negative, to that structure.

Hypergroup

Established at the beginning of the semester, the Hypergroup allowed for ongoing exchange between students and instructors as well as facilitated the development of peer relationships. Through this medium, we encouraged feedback and collaboration among our students throughout the semester.

> This is your online discussion group. You will use this area to ask questions, share ideas, and communicate with your peers and instructors...Your instructors will be reading and posting discussion topics to help you get started. We are looking forward to working with all of you this semester. (First Hypergroup posting, Tech Fellows, August 23, 2000)

For instructors restructuring their undergraduate technology courses for pre-service teachers, an important consideration should be the inclusion of a communication tool that promotes positive peer interactions. By the second month participation in the Hypergroup was going strong with future teachers sharing ideas, posting resources, and communicating common concerns. The Hypergroup, originally intended as an example of a mode for teacher communication, has turned into a true community-building tool.

> Don't panic! I know it seems a little confusing but you can handle it. The structure of the class has been a little confusing and you kind of have to do things on your own. If you take time to read the ISTE indicators you can break things down and develop a 1-page reflection. I will be more than happy to help you in any way I can. Feel free to e-mail me and ask for suggestions. We might just be able to help each other out with the class (Hypergroups, student, November 16, 2000)

Interviews

Interviews conducted at the middle and end of the semester by a research associate affiliated with the PT3 grant but not directly involved in the instruction of CUIN 3111 allowed instructors to gather anonymous input regarding course structure. Interview transcripts, summarized and presented to the instructors, revealed that students were deeply invested in their progress and roles as co-developers of the course format.

> I'm a student in the CUIN 3111. I would like to thank you for coming in to interview the students in the class because it really [gave] us a[n] opportunity to give our input about

> the course. Also with this program being new, I think the interview will allow the students a chance [to] take part in molding the course (Hypergroups, student, October 11, 2000)

One student, when asked to develop a metaphor to describe the experience of the new course design, stated:

> It's like jumping on a boat not knowing how to sail but someone more experienced will help you along, so it isn't like sink or swim (interview, student, September 25, 2000)

Skill Development

Our development as instructors in this course correlates directly to student feedback from two qualitative research methods: ethnographic interviews conducted by an outside interviewer and from a web-based newsgroup application (Hypergroups). Because this class is based on the ideas described by action research, we seek to provide an atmosphere of trust and openness that allows us to record, evaluate, and respond to student perceptions regarding their own learning (Lawler, 1985; Stringer, 1999).

Direct Instruction

Student interviews revealed a wide range of perceptions regarding the new class structure. Some students indicated that the structure of the course allowed freedom to work at their own pace, whereas others felt that the class was directionless and lacking in focus.

Students who are not accustomed to the process of defining their own learning are likely to feel a sense of frustration because they are not receiving the direct instruction with which they have grown familiar. In that sense, student responses are somewhat encouraging in that we have remained true to the constructivist principles. While we wish to maintain the constructivist approach we also acknowledge that student expectations play an important role in their success. Our students have asked for and will receive more direct instruction. Our plans for future semesters will include scheduled mini-workshops based on needs expressed by students. Students will have the option to participate in these lessons based on their needs.

Connections

One of the stated goals for the new course was to connect technology experiences in CUIN 3111 to methods courses in which students were concurrently enrolled. Some success in this effort is apparent, however, student responses still indicate a significant gap between technology expectations in the new course and those of instructors of their methods classes. While we have attempted to ameliorate this discrepancy by allowing students to complete projects for personal use rather than direct relationship to other coursework, our ultimate goal remains unfulfilled. We will continue our efforts to increase technology diffusion throughout the pre-service education program and hope to see the effect of these efforts in future semesters.

Deadlines

At mid-semester, it became painfully apparent to both instructors and students that a schedule for submitting the reflective papers was necessary and advisable. This requirement was expressed numerous times during student interviews, through Hypergroup postings, and in conferences with the instructors. Therefore, the decision to require that half of the reflections be submitted by mid-semester seemed intuitive.

Resources

Students also indicated a need for resources related to the course to be located at a central site for easier access. To that end, construction of a course web site that includes all current resources has been ongoing. This web site will be launched at the beginning of next semester and will include items requested by students such as examples of model reflective papers, ideas for project completion, tutorials for basic

applications, and helpful websites. The site will be updated according to the needs expressed by the students. As such, the web site will become another tool for student response to the structure of the course. In addition, a textbook containing examples of technology-based lessons and ideas will be adopted.

Hypergroup

Interviews revealed that the Hypergroup established for the students was accepted favorably. Students stated that the Hypergroup gave them access to information and helpful web sites as well as allowed them to communicate regularly with instructors and peers. Due to these resoundingly positive responses, the Hypergroups will stay intact for these pre-service teachers throughout their teacher education program and into their first year of teaching where it is hoped that these teachers will become a part of other online peer resource groups.

Future Goals

According to action research methodology, the recording of student response requires evaluation, synthesis, and response by the instructors. As described above, we have distilled student responses and formulated our own response that will become the kernel around which the next semester's course will develop. Summarized below are the actions that will be taken to change course design; all of these changes are based on student responses.

- Continue working to achieve concurrency between methods courses and CUIN 3111.
- Publish a course web site which provides greater access to resources.
- Provide direct instruction by way of mini-lessons and hands-on workshops on a bi-weekly basis.
- Incorporate concrete deadlines for blocks of reflections.
- Continue utilization of the Hypergroup.

The expected outcome of these changes should yield a new series of responses which can then be employed to further refine the structure of the new computer course.

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Pilot Results of a Teacher Education Infusion Model

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Abstract: This paper is a report on the results of a pilot project funded through Preparing Tomorrow's Teachers to Use Technology (PT3) Initiative. Project PICT (Preservice Infusion of Computer Technology) was piloted during the 1999-2000 academic year and focused its efforts in technology infusion on the elementary education program. The project is described in the context of the ISTE (2000) Essential Conditions for technology integration. This paper describes ISTE's essential conditions for technology integration, how Project PICT fulfills these conditions, evaluation methods utilized by PICT, pilot results, and implications for further research and practice.

Introduction

As educational institutions have attempted to utilize technology as a learning tool, researchers have consistently identified numerous barriers that impede the training, development, and implementation process of technology infusion (Parker, 1996; Seminoff & Wepner, 1994; Wetzel, 1993). With these results in mind, ISTE has identified ten essential conditions —shared vision, access, skilled educators, professional development, technical assistance, content standards and curriculum resources, student-centered teaching, assessment, community support, and support policies--that "are required to create learning environments conducive to powerful uses of technology" (ISTE, 2000). These conditions form the framework for Project PICT (Preservice Infusion of Computer Technology), an initiative that seeks to prepare preservice teachers to effectively use technology as a learning tool by infusing technology in Bowling Green State University's teacher education programs. Funded through the Preparing Tomorrow's Teachers for Technology (PT3) initiative, Project PICT was piloted during the 1999-2000 academic year and focused its efforts in technology infusion on the elementary education program.

Creating a *shared vision* of technology infusion among stakeholders and leaders has been difficult for many institutions due to the evolving nature of technology and subsequently the varying purposes for using technology in the classroom (Valdez, et al, 1999). However, as research on the impact of educational technology use has been conducted and disseminated, policymakers, funding agencies, administrators, and educators are espousing a vision in which technology is a tool used to engage students in meaningful learning, understanding, and exploration (Cifuentes, 1997; Nicaise & Barnes, 1996; Perkins, 1992). Thus, Project PICT sought to facilitate a dynamic and constructivist vision of technology infusion where an assortment of technologies and applications were used to enhance the creation of products, facilitate problem solving, and assist exploration. This vision was introduced to Project PICT participants (HE faculty, K-6 educators, K-6 administrators, technology coordinators, and preservice teachers) at the very first workshop where technology-using educators presented example lessons and products that demonstrated how they had effectively used technology as a learning tool. Participants were directed to resources that exemplified constructivist uses of educational technology. Training sessions also facilitated discussion on meaningful uses of educational technology and appropriate instructional methods for technology infusion. Activities that established this shared vision were cited by PICT participants as the most motivating among the project.

Despite the billions of dollars spent annually on technology in our nation's schools, *access* continues to be a barrier for many educators and students (USDE, 2000). Access has been cited as a primary impediment to faculty

development of technology infusion since faculty may not have the necessary equipment, software, or network access to practice applying skills and methods learned during training (Parker, 1996). Such on-going training and practice is necessary for educators to feel comfortable with the newly learned technologies and confident in implementing them in the classroom. Project PICT addressed the issue of access by providing each participant with a laptop computer that included all the necessary software as well as modem and network cards. K-6 teachers had laptop use only during their participation in the grant; whereas, HE faculty were allowed to keep their laptops after they completed one year in the project and continued as BGSU faculty. Another area of access pertinent to HE faculty was classroom access. Although BGSU has numerous computer labs, access to these labs is difficult due to class demands. Consequently, Project PICT in collaboration with BGSU developed five electronic classrooms in the College of EDHD. Each classroom housed a ceiling mounted projector, a laptop, and Internet connection. The electronic classrooms allow HE faculty to demonstrate and model effective technology uses. A portable system (laptop and projector) is also available to faculty not scheduled in an electronic classroom.

Professional development was a primary focus of Project PICT as it sought to the train general faculty, education faculty, and K-6 teachers in methods of technology infusion. Project PICT's Training Model sought to prepare technology-using HE faculty and K-6 teachers, who would model effective technology infusion by demonstrating technology applications and facilitating student use of technology. The training model was based on several beliefs and research findings: 1) Professional development should "center on creating sustained learning communities where participants have an active voice in determining goals and activities of the project" (Beyerbach, Walsh, & Vannatta, In Press); 2) Training should be focused and on-going; 3) One-on-one mentoring programs have effectively prepared education faculty for technology enriched instruction (Thompson, Hansen & Reinhart, 1996); 4) Training programs should consistently communicate expectations and requirements (Topp, Mortenson, & Grandgenett, 1995; Vannatta, 2000). Consequently, the Project PICT Training Model included the following components:

- Creation of *shared vision* of technology infusion through workshops on meaningful technology use, NETS-Students, NETS-Teachers, and performance-based assessment.
- *Team collaboration* in which team members supported one another in lesson development and implementation. Each team was required to develop and present a team plan for technology integration. Teams were formed by participants and consisted of K-6 teachers, preservice teachers, education faculty, and arts & sciences faculty.
- *One-on-One mentoring/collaboration* in which preservice teachers were assigned to K-6 teachers for methods and student teaching. During this year-long placement, pairs completed training together and were required to develop and implement four technology-enhanced lessons.
- *Focused technology training* on applications and methods for technology infusion. Participants were required to attend five sessions on multimedia and Internet applications. During sessions, participants were presented numerous examples of technology-enhanced lessons, discussed classroom management issues and methods of implementation and assessment.
- Since PICT participants volunteered, consistent *communication of expectations* was integral in recruitment and retention efforts. Participants were required to attend all training sessions; participate in team collaboration activities (development and presentation of team plan); development and implementation of two technology-enhanced lessons/units; submit technology rich course syllabi, lesson plans, and student products; and participate in data collection activities. These expectations were communicated with the long term goal of systematic technology infusion throughout the teacher education programs.

Technical assistance is such a crucial component of any technology endeavor. For technology infusion within teacher education, technical assistance must be provided at nearly every aspect of the process: orientation, training, practice, development, implementation, and revision. Project PICT utilized several methods to provide technical support. Optional Tech Support Nights were provided, in which project participants could attend to receive one-on-one assistance on equipment, applications, and/or instructional methods. Another method of support was providing participants with access to several technology-savvy graduate students, who could attend technology-rich lessons or events. Their presence often alleviated a great deal of anxiety among the novice-level educators. Finally, project staff were available on an individual basis to answer questions or visit classrooms.

The preparation of teachers requires the instruction of a multitude of *content areas*. Consequently, effective training on methods of technology infusion must address these content areas. Project PICT provided numerous technology-rich examples (lessons, products) for various content areas and grade levels. These examples were presented within training as well as the Project PICT website. The project website also provided numerous links to other educational technology-rich sites by content area. The website continues to grow as participants continue to submit appropriate lessons and products. Participants also received a copy of *Connecting Curriculum* to guide lesson development and implementation.

Facilitating a constructivist vision of technology infusion includes the adoption of *student-centered teaching*. Within training sessions, participants learned about ways in which technology could facilitate active, cooperative, and project-based learning (ISTE, 2000). Example lessons and products demonstrated student-centered approaches. Implementation of student-centered teaching and technology infusion often raises concerns regarding *assessment* among educators. Project PICT addressed the issue of assessment from several directions. First, participants were introduced to methods of performance-based assessment. In addition, appropriate assessments were required of all lessons submitted to the project. Second, participants were introduced to the NETS-Students, which allowed them to develop grade-appropriate lessons and assessments. Finally, participants were introduced to the NETS-Teachers. Since a long-term goal of the project was to create an assessment system of technology infusion for preservice teachers based upon restructured teacher education curriculums, HE faculty needed to become aware of how these teacher technology standards could be addressed and assessed within their courses. The pilot of Project PICT allowed for curricular experimentation among HE faculty.

Although instruction and modeling of technology infusion within the university setting is necessary to develop technology-using educators, future teachers also require the opportunity to observe, develop and implement technology-enhanced lessons in the K-12 classroom. Such *community support* can only occur with adequately trained K-12 teachers, who effectively use technology as a learning tool. Consequently, Project PICT also sought to better prepare area K-12 teachers for technology infusion. As these classroom teachers begin to integrate technology into the classroom, their growing expertise assists education faculty in understanding K-12 technology use and ultimately infusing technology in their education courses. Such assistance/collaboration may be demonstrated by: education faculty utilizing K-12 technology-rich lessons as models and examples; fieldtrips to the K-12 and/or university classroom; K-12 teacher presentations to preservice teachers; video-conferencing between the K-12 classroom and the university classroom.

Finally, developing *support policies and providing incentives* is essential to gaining support and momentum among educators. PT3 funding allowed Project PICT to provide a reward structure for participants that not only provided incentive but also alleviated several barriers to technology infusion that are often cited in the literature. For educators, one of the primary barrier to learning and implementing an innovation is lack of time ((Parker, 1996; Seminoff & Wepner, 1994; Wetzel, 1993). While the idea response to this barrier would be to provide time through course release, unfortunately a faculty shortage does not allow this. To address the issue of time, participants are paid a stipend for the time that they commit to the project. K-6 teachers received $2,000 per year, while HE faculty received the equivalent of teaching one course during the summer (10% of base salary). Another incentive that addresses the barriers of time and access is providing participants with laptop computers. The laptop provides convenience for practice and development. Although the pilot project did not provide laptops to the participating preservice teachers, incentives included: advanced training on technology infusion, opportunity to collaborate with a K-6 teacher for the year, experience in developing and implementing technology-enhanced lessons that could be exhibited in one's professional portfolio, and a $200 stipend. Finally the project also provided stipends of $500 to the technology coordinators at the participating schools, since they supplied additional support for participants.

Evaluation

Research Questions

The following questions guided the evaluation of this project.

1. Do technology training and planning activities increase technology proficiency and implementation among HE faculty and K-6 teachers?
2. How does the experience of serving as a preservice technology collaborator impact technology proficiency and view of technology infusion?
3. Does technology integration in methods courses increase preservice teachers' technology proficiency?
4. Does technology integration in methods courses impact preservice teachers' view of technology infusion?

Participants

Eight HE faculty members participated in the pilot of Project PICT. These instructors varied in rank and were from either the division of teaching and learning or the college of arts and sciences. Ten K-6 teachers also participated in the project and taught at two well-established professional development schools. Ten preservice teachers majoring in elementary education also volunteered to participate as technology mentors/collaborators. Finally, nearly 125 preservice teachers enrolled in elementary methods participated in numerous technology-related activities throughout spring 2000. Ninety-five completed pre and post surveys.

Methods

Evaluation activities were conducted throughout the grant period. Quantitative and qualitative methods were utilized to fully understand the project and its impact on participants. Pre and post surveys were administered to all participating HE faculty (N=8), K-6 teachers (N=10), preservice technology collaborators (N=10) and selected preservice teachers enrolled in methods courses during the spring semester (N=95). These surveys measured technology proficiency, use of technology by instructor, and use of technology by student. Survey results were analyzed using descriptive and inferential statistics. T test of related samples were conducted to examine pre and post differences. In addition, preservice teachers were asked to describe their vision of technology integration. HE faculty, K-6 teachers, and preservice technology collaborators also participated in focus group interviews at the conclusion of the project. Interview questions elicited information regarding the technology activities they implemented, the degree of support they received, the grant activities that most facilitated their technology integration, and their vision of technology infusion. Group interviews were conducted by a project co-director with 3-5 individuals from each group (i.e., faculty, K-6 teacher, preservice technology collaborator). Observations were conducted of technology activities implemented in the education courses and K-6 classrooms. In addition, lesson plans, student projects (preservice and K-6) were analyzed.

Instrumentation

Two instruments were utilized in the evaluation of this pilot project: the Faculty Technology Survey and the Preservice Teacher Technology Survey (Vannatta, 2000). Both instruments were similar in content and format as they measured technology proficiency and integration/experiences in courses. While the directors recognized that development of individual technology proficiencies does not necessitate a constructivist environment, proficiency of at least 1-2 applications coupled with an understanding of instructional methods is essential for constructivist integration. In addition, the directors were interested in determining which proficiencies and uses were targeted by the participants. Consequently, nineteen items asked participants to report current proficiency using computer equipment, applications, and instructional methods for integrating technology. These items utilized a Likert scale of 1-4 in which 1 represented no proficiency and 4 represented high proficiency. Participants were also asked to identify, from a list of seventeen computer applications/activities, which specific activities were currently being utilized by the instructor in their classrooms. These items utilized a Likert scale of 1-4 in which 1 represented no use and 4 represented frequent use. Participants also reported the degree of student use of technology in the classroom . These seventeen items applied a Likert scale. HE faculty and teacher participants were also asked to report the degree to which they use technology for six different administrative tasks; a Likert scale was also applied. Finally, an open-ended questions was posed to all the participants as they were asked to describe their vision of a technology-rich classroom.

Due to the various participant groups, surveys were administered in different settings. Participating HE faculty, K-6 teachers, and preservice technology collaborators completed the pre survey in September 1999 and the post survey in April 2000 during project meetings. Preservice teachers enrolled in methods courses during spring 2000 were administered pre (January 2000) and post (April/May 2000) surveys during their methods courses.

Results

Impact of HE Faculty and K-6 Teachers

Participating in training together, collaborating to develop and implement technology-enhance lessons, and teaming to support one another in the professional growth process, HE faculty and K-6 teachers reported significant increases in overall proficiency and infusion in the classroom. Proficiency significantly increased in all but five (distance education, database, spreadsheet, website development, and Internet) of the nineteen technology areas (see Table 1). Instructor use in the classroom significantly increased in ten of the seventeen technology areas as well as overall infusion (see Table 2).

	Faculty & Teachers (n=18)	Preservice Tech Collaborators (n=10)	Methods Students (n=95)
Computer	-3.674**	-5.292**	-3.242**
Digital Camera	-6.548**	-10.539**	-2.018*
Scanner	-3.556**	-4.264**	-2.804**

Projector	-5.551**	-4.128**	-2.106*
Distance Ed	.563	1.000	.000
Word Processor	-2.256*	-1.512	-1.639
Database	-1.835	.800	-.177
Spreadsheet	-1.825	.359	-.198
Drawing/Graphics	-4.583**	-1.000	-.183
Website Development	-1.702	-.426	-1.290
Electronic References	-3.674**	-1.941	-2.926**
Listserves/Disc groups	-3.568**	-2.828*	-3.516**
Instructional Software	-3.389**	-1.348	-2.246*
Presentation Software	-7.122**	-5.547**	-2.221*
Multimedia	-7.483**	-5.774**	-2.761**
Email	-4.000**	-.555	-1.481
Internet	-1.286	-2.101	.000
Assistive Technologies	-2.188*	-1.000	-.771
Instructional Methods	-8.411**	-4.472**	-2.419*
Overall	-6.764**	-4.510**	-4.394**

Note: *p<.05, **p<.01

Table 1: t-test Related Samples Results for Technology Proficiencies

	Pre		Post		*t*	*p*
	M	SD	M	SD		
Digital Camera	1.333	.816	2.467	.834	-5.264	<.001
Scanner	1.267	.458	1.867	.743	-3.154	.007
Projector	1.400	.633	2.867	.916	-6.813	<.001
Distance Ed	1.133	.352	1.200	.775	-.292	.774
Word Processor	2.867	1.356	3.800	.561	-2.357	.034
Database	4.133	10.769	2.067	1.033	.759	.460
Spreadsheet	1.467	.640	1.800	.775	-1.435	.173
Drawing/Graphics	1.467	.640	2.600	.986	-3.371	.005
Website Development	1.000	.000	1.133	.352	-1.468	.164
Electronic References	1.667	.976	2.400	.910	-6.205	<.001
Listserves/Disc groups	1.333	.817	1.733	.594	-1.382	.189
Instructional Software	2.200	1.265	2.600	.986	-1.871	.082
Presentation Software	1.267	.594	2.133	.743	-4.026	.001
Multimedia	1.400	.737	2.933	.961	-5.002	<.001
Email	2.000	1.254	3.400	1.121	-4.010	.001
Internet	2.133	1.126	3.000	1.195	-2.229	.043
Assistive Technologies	1.133	.352	1.286	.611	-.694	.500
Overall Use	29.200	15.558	39.200	4.443	-2.737	.016

Table 2: Teacher-Technology Use in the Classroom Reported by Participating Faculty and Teachers (n=18)

Analysis of observations, lesson plans, and student artifacts revealed that participants were able to transfer many of the technology ideas presented to them in training to their classrooms. Example lessons for K-6 teachers addressed: creating trading cards of historical figures, events, and/or innovations using KidPix; developing book reports using HyperStudio; creating student "yellow pages" using digital camera and word processing; creating presentations using HyperStudio. Readers are encourage to visit the Project PICT website (www.bgsu.edu/colleges/edhd/LPS/EDFI/PICT/) to view lessons that resulted from the pilot. Example lessons integrated in education courses included: creating community profiles using a digital camera and PowerPoint; having elementary students visit the university classroom to train preservice teachers on KidPix; using the Internet to find technology-enhanced lessons; simulating several of the K-6 technology-rich lessons.

Focus group interviews revealed evolving views of technology use in the classroom. Prior to involvement in Project PICT, the majority of teachers indicated a perspective limited to drill and practice applications. After participation, teachers and faculty expressed a more constructivist view in which technology was used as an instructional tool to facilitate student motivation, exploration, creativity, communication, and problem solving.

"Technology can open up doors where some students may never get an opportunity." Although HE faculty were familiar with a constructivist perspective of technology infusion even before the project, they indicated that their participation made them realize that "the vision is something that could be accessible for both classroom teachers and methods students."

Impact on Preservice Technology Collaborators

The preservice technology collaborators played a unique and integral role in this project. Ten preservice teachers volunteered to be placed with a K-6 teacher for both methods field experience and student teaching. These students completed a typical elementary methods block that consisted of four elementary methods courses during the first eight weeks of the semester and full time fieldwork in a K-6 classroom during the second eight weeks. In addition, the preservice technology collaborators attended all technology training and team meetings with their cooperating teacher. Spring semester provided a twelve-week student teaching experience. These participants were expected to develop and implement at least two technology-enhance lessons/units during student teaching. Since the preservice technology collaborators worked so closely with their cooperating teachers to infuse technology in the classroom—an amazing relationship was revealed. While the cooperating teachers were extremely knowledgeable of classroom curriculum and management, the preservice technology collaborator was somewhat more knowledgeable about technology applications and definitely more of a technology risktaker. The marriage of these strengths developed a supportive, creative, and exciting classroom environment for technology development and implementation.

Analysis of the focus group interviews with cooperating teachers and PT collaborators revealed two primary themes—emotional support and instructional support—that describe how this relationship was essential in facilitating technology infusion. Several of the participants cited how important it was just having a second teacher in the room to manage the various activities (e.g., cooperative learning groups, learning centers, troubleshooting) involved in a technology-enhanced lessons. The collaborative process also provided a great deal of emotional support. Participants cited a sense of security and comfort in working with someone else while trying something completely new. One teacher stated, "Working with my intern [PT collaborator] was the component that meant the most to me. To have someone who knows more than I do and who's there to help lead me into finding the answer made all the difference for me!"

This experience had a profound impact on the preservice teachers serving as technology collaborators. Survey results revealed significant increases in overall technology proficiency, knowledge of instructional methods, and proficiency of 7 of 18 technology applications among the PT collaborators (see Table 1). However, the greatest impact came in how these future teachers view technology infusion and their prospects in the classroom. Prior to PICT, nearly all the technology collaborators viewed technology use in the classroom as using games, drill and practice, and possibly the Internet. Following PICT, several participants indicated that, "I now see technology as a key facet in the information age. I hope to have my student using computers as a tool to collect data, organize information, and create product."

Impact on Preservice Teachers Enrolled in Methods Courses

Participating HE faculty were required to develop and implement at least two technology-enhanced lessons for their methods courses. The impact that this infusion had on preservice teachers enrolled in these courses was measured through pre and post surveys. Survey results indicate that technology infusion in the methods courses had a significant effect on technology proficiency (see Table 1). Overall proficiency as well as nine of the nineteen areas of technology proficiency significantly increased during the semester. Changes in vision of technology use were also assessed through open-ended survey questions. Responses indicated that the majority of students felt that technology is an important instructional tool, however, most were still vague about how technology could be used to facilitate learning. Several comments focused on the hardware necessary to have a technology-rich classroom and not the pedagogy in using it as a learning tool.

Conclusions

The pilot of Project PICT had an impact on technology proficiency, infusion, and vision among the participating HE faculty and K-6 teachers. In addition, project activities had a significant effect on technology proficiency among methods students. Project PICT has received funding through PT3 to expand its endeavor to secondary and special education programs. ISTE's essential conditions continue to serve as the foundation of the project's activities.

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Technology Chalkboard: Building a Collaborative Model to Integrate Technology in the Classroom

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Abstract: Integrating technology into the classroom is an evolutionary (if not revolutionary) process for most educational institutions. In rural Western Pennsylvania three State System of Higher Education universities formed a consortium to address the need to increase faculty understanding of the advantages of using technologies in teaching, their competencies in specific technological applications, and their level of comfort in using them. The universities created learning and technology centers to provide technology-rich learning environments for university faculty and K-12 teachers.

A $1.7 million Preparing Tomorrow's Teachers to Use Technology (PT3) implementation grant provided funding for new methodologies for infusing technology in the classroom. A "technology chalkboard" model was developed to provide diverse classroom learning opportunities. Technology modules incorporated foundation training on specific software or technologies, application training on how the technology is applied in the classroom and integration training on how the technology enhances student-centered learning.

Introduction

The Advancing the Development of Educators in Pennsylvania through Technology Training (ADEPTT) consortium, representing three public universities (Clarion, Edinboro and Indiana Universities of Pennsylvania) in rural, economically disadvantaged communities is implementing a model for infusing instructional technology throughout the teacher preparation curriculum. Initially funded by a 1998 $500,000 Bell Atlantic grant, the universities created learning and technology centers to provide technology-rich learning environments for university faculty and K-12 teachers. Each ADEPTT center is comprised of a core team including a director, instructional designers, administrators, and faculty representatives from disciplines in the colleges of education, arts and sciences and business. Over the past three years the core teams have assisted one another in establishing centers devoted to teaching excellence, instructional design and the use of instructional technology to move from a teacher-centered to a student-centered learning environment. Through the ADEPTT consortium the universities have formalized their relationship and greatly expanded their ability to work together to develop materials and training for all faculty at each institution.

The ADEPTT Centers provide basic and advanced training in computer literacy and numerous software applications and web tools. The first year the centers focused primarily on foundation training for faculty offering a total of 182 workshops across the consortium in eleven key competencies (Fig. 1). However, it became apparent that knowing *how* to use the technology was not enough to effect change in instruction and that incentives were needed to break down the barriers to widespread participation.

Eleven Key Competencies

Operating System Management	Word Processing	Spreadsheets	Web Browsers
Email	Presentation Software	Databases	Multimedia Packages
Videoconferencing	Chat and Threaded Discussion	Internet in Teaching	

Figure 1: Key competencies address basic needs for infusion of technology into the curriculum.

Barriers and Challenges to Integrating Technology in the Classroom

- Faculty and K-12 teachers have little time to develop technology-based instructional materials, which reduces the likelihood they will integrate technology into their courses.
- Relatively few teachers are prepared to integrate educational technology into the classroom. In a 1990 national survey, 81% of the student teachers surveyed rated their undergraduate preparation in technology use as inadequate (Fratianni, Decker & Korver-Baum 1990). Even though schools are slowly increasing the amount they spend on training, just eight percent of schools say the majority of their teachers have advanced skills and are able to fully integrate technology into the curriculum (Weiner 2000).
- An Office of Technology Assessment report revealed that while half of recent teacher education graduates reported being prepared to teach with technology in drill and practice, tutorials, games, and writing and publishing centers, less than one in ten felt they could use such formats as multimedia packages, electronic presentations, collaborations over networks or problem-solving software (Thomas, Larson, Clift & Levin 1996).
- New technology standards (NCATE/ISTE) at the state and national level are leading schools and universities to realign their teacher education curricula to include technology components.
- Universities and schools are reluctant to offer release time due to the difficulty in obtaining replacement instructors and substitute teachers for their classes.

Preparing Tomorrow's Teachers to Use Technology

Overcoming the barriers to integrating technology necessitated the pursuit of additional funding. Through collaborative efforts the consortium received a $1.7 million Preparing Tomorrow's Teachers to Use Technology (PT3) implementation grant in 1999 to infuse instructional technology into the teacher education curriculum. The goals of the PT3 grant complemented the ADEPTT strategies already in place to support faculty and K-12 teachers in integrating technology. The goals--to infuse instructional technology more deeply into the teacher education curriculum, to integrate instructional technology in the consortium's pre-service observation and field experiences, to provide a variety of professional support opportunities for faculty and pre-service teachers, to enhance the technological infrastructure of the consortium members to better support the project objectives--are being addressed in a number of ways.

The PT3 funds provide professional development opportunities and instructional design support for education core/methods faculty and personnel to deliver application and integration training for faculty and pre-service teachers. Application and integration training facilitates the development of lesson plans, materials, and resources to infuse technology in the classroom. Modest numbers of early adopters are

beginning to add technology-enhanced assignments to their courses and are serving as models and trainers for both their colleagues and their students. The barrier of time and scheduling, however, continued to be a problem for faculty. A new model was conceptualized to deliver an intensive technology-rich experience during the summer, at a time when faculty are more likely to be available for training opportunities. Thus, the "technology chalkboard" model was born.

The Technology Chalkboard Model

Technology chalkboard was initially developed for education core and methods faculty as a week-long immersion in technology applications that includes foundation, application, and integration strategies for the classroom. Its modular approach was designed to lower the entry level for faculty and teachers to enable them to be comfortable in exploring the technologies. No prior experience in using technology was required.

The model incorporates the use of a combination of educational technology applications. The nine technology modules (Fig. 2) each focus on three areas:

1. foundation training on the basics of the software or technology
2. application training on how the technology is applied in the classroom
3. integration training on how the technology enhances student-centered learning

For example, the videoconferencing module includes an explanation of videoconferencing as a type of distance education. The opportunities, theories, and applications of videoconferencing in K-12 education are presented and case studies are examined where videoconferencing has been used successfully. Pre-service teachers and their cooperating teachers learn how to use the equipment and demonstrate this knowledge in the creation of a videoconferencing event.

Technology Chalkboard Modules

Reshaping Classrooms Using Technology	Developing Instruction Online	Electronic Communication and Collaboration
Videoconferencing for K-12 Education	Mindtools	WebQuests
Digital Imaging to Enhance Instruction	Developing Multimedia Presentations	Integrating Electronic Spreadsheets

Figure 2: Nine technology chalkboard modules incorporate foundation, application and integration of technology.

The format for the technology chalkboard model is based on a hands-on approach with workshops, demonstrations and practice during a one-week period. The Learning and Technology Center at Clarion University held the first technology chalkboard series for education faculty July 17-21, 2000 in a smart classroom equipped with 30 Macintosh PowerBook computers, ethernet connections, and a teacher station with a laptop, projector and smartboard. The workshop schedule featured two technology chalkboard modules each day that were divided into the three focus areas: foundation, integration and application. To augment the classroom experience, participants were enrolled in a specially created online course supplement using Blackboard's CourseInfo software that provided them with a student's perspective to using online courseware. The online component provided participants with a syllabus, course documents, discussion areas and links to related information that they could continue to use after the workshop ended.

Lunch was provided each day and speakers were invited to discuss current topics on technology. The on-site lunches promoted discussions and sharing in ways technology could be used in the classroom. It was hard to get participants back to the workshops on more than one occasion. The presentations reflected the daily technology themes; for example, Dr. Gail Grejda, Dean of the College of Education and Human Services, "Educational Standards: A Changing Mosaic"; John Sikora, Apple account executive, "Integrating Digital Video into the Curriculum"; Sonja Heeter, technology coordinator, Riverview Intermediate Unit 6, "Seeing is Believing!?"; Dr. Helen Barrett, University of Alaska, "Creating Electronic Portfolios: Building a Standards Based Portfolio" and Dr. Sanjay Rebello, physics department faculty member, "Student Surveys on Web-Assisted Instruction".

Presentations by outside speakers and members of the consortium were found to be an important component in the model by providing valuable insight into how technology can be used in the classroom. In particular, Dr. Barrett's presentation executed via desktop video, the Internet and conference phone enabled the participants to interact with her while she was at home in Alaska at 6:00 a.m.

One of the participants evaluated the experience in this way; *"The entire week was the most beneficial of all the computer course work I have had to date. I just wish I could have yet another week to become more proficient. Thank you so much for being patient and helping me to become more aware of what is available to me with technology in my classroom."*

Due to the success of the technology chalkboard model, funding is being pursued to create an online module for each of the technology chalkboard components that will be used to supplement the pre-service teacher curriculum. The modules will be Web based to allow for anytime, anywhere learning, meeting the needs of the pre-service and in-service teachers. The modularized units will be based on International Society for Technology in Education (ISTE) standards to promote the use of technology in the student's field experience and make connections between the technology and the curriculum.

Implementing The Online Model

Three faculty from each consortium member institution, working closely with the ADEPTT centers, will develop nine technology-rich online modules based on the "technology chalkboard" model. The modules will incorporate International Society for Technology in Education (ISTE) standards of instruction providing foundation, application and integration skills through a common design. The modules will incorporate three basic components:

- foundation – tutorial format – "how to" use the technology
- application – align lesson creation with state/national standards
- integration – student created technology-rich lesson plans

Each of the nine modules will be shared among the institutions. They will be developed for Web delivery (Blackboard, WebCT, etc.) and shared through the consortium's ADEPTT/PT3 Web sites. Three cooperating faculty at each institution will incorporate one of the online modules in their courses during the Fall 2001 semester. To facilitate the course development process, faculty will attend sessions held by their respective ADEPTT centers on creating online courses. To encourage participation, cooperating faculty will receive a small honorarium. At the completion of the course, faculty will review the modules through the completion of a short survey and a written evaluation.

Students will complete at least one of the online modules as part of the teacher education curriculum prior to their student teaching experience. Cooperating teachers will be paired with pre-service teachers and complete the modules online during the same period. To encourage participation in the project, the cooperating teacher will be paid a stipend to participate in the program and may also receive ACT 48 credit. Both the pre-service and cooperating teacher will be required to create a lesson plan for the module based on ISTE standards that will then be used in the K-12 classroom during the student teacher experience.

Exemplary lesson plans that have been developed by the pre-service and in-service teachers will be included in an ADEPTT database developed at Edinboro University and on the consortium's ADEPTT/PT3 Web sites to provide K-12 teachers in Pennsylvania with technology resources. Technology modules will be available to all faculty at the consortium institutions. All nine modules may also be developed into a special topics course culminating in the creation of student electronic portfolios. The program model may also be disseminated through the State System's Center for Distance Education and through presentations by ADEPTT/PT3 locally and at state and national conferences.

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A Faculty Development Plan For the Successful Integration of Technology Into Teacher Preparation Courses

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Abstract: With unprecedented emphasis being placed on preparing pre- and inservice teachers to integrate technology into their classrooms, schools of education are facing increasing pressure to provide students with experiences and faculty who can adequately prepare them for this task. This paper presents details on how one college of education in a small liberal arts university is meeting this challenge. Using the National Educational Technology Standards for Teachers (NETS-T) as a basis, education faculty worked together to implement a faculty development program that culminated in the measurable integration and utilization of technology in the program's professional studies classes. The outcome of this semester-long collaboration was that the methods faculty involved were better prepared to (a) utilize technology as a tool for instruction, (b) train their students/preservice teachers to utilize technology in the classroom, and (c) serve as technology mentors to other methods faculty.

Introduction

As a member of a statewide consortium of Alabama schools of education, the University of Montevallo received PT3 grant funding to create and implement a faculty development plan designed to lead to the successful integration of instructional technology in professional studies methods classes in its Teacher Education Program. Additionally, the implementation, evaluation, and refinement of this structured technology integration plan could potentially serve as a model for other schools of education throughout the state. This plan was based on the National Educational Technology Standards for Teachers (NETS-T) as offered by the International Society for Technology in Education (ISTE).

Through this project, one faculty member from each of two methods classes, math and social studies, and the college of education's director of instructional technology worked together to implement a series of planned steps designed to culminate in the measurable integration and utilization of technology in teacher preparation classes. The two methods faculty met biweekly for one semester with the technology director in a series of discussions and hands-on lessons related to technology integration. In addition to these regularly scheduled meetings, the technology director routinely assisted the two faculty members in developing various technology-based projects.

For the two methods faculty involved, the commitment was the same. Both would attend all seven of the scheduled meetings, work collectively and individually on assigned projects, keep a journal of their reactions to the overall experience, and be willing to serve as technology mentors to other faculty in the future. Each also received paid release time from one fourth of their required academic responsibilities. The technology director's

responsibilities were to develop and facilitate the training sessions and to work as needed with the two participating faculty members on the creation and integration of their projects. The scheduled topics for each session were as follows: Equipment Setup and Operation, Using PowerPoint for Instructional Support, Planning for Effective Technology Integration, Incorporating Educational Software in Teaching and Learning, Incorporating the Internet in Teaching and Learning, and Resources for Teachers.

About the Project

From the beginning, each scheduled meeting during the project was characterized by an active exchange of information and concerns involving the use of technology in the college and elementary classroom. While both methods faculty were excited about utilizing technology in their courses, each remained very practical in their intentions for its use. Whether the topic was equipment setup and operation or the advanced features of PowerPoint, both educators consistently directed the conversation toward issues of practicality and educational effectiveness. This became an underlying theme for all meetings and conversations regarding technology throughout the project. Too often, training programs aimed at helping teachers with the integration of technology focus solely on technology operation while overlooking the practical matters of successful integration, leaving the teacher no more prepared to integrate technology than he or she was prior to the training. It is extremely important for anyone considering this type of faculty development program to insure that the training places strong emphasis on practical concerns.

In addition to the hands-on training, much time was spent sharing ideas and examples of the successful use of technology. For instance, during the sessions covering PowerPoint, both methods professors were provided with a disk containing unique or atypical examples of PowerPoint presentations. This served as a springboard for the two faculty members to begin discussing and formulating plans for their own presentations. The examples clearly helped them break away from thinking of PowerPoint merely as a tool to present lecture notes to students, which is the only way they had used Power Point prior to this experience. Throughout the project, this sharing of ideas and the discussions that ensued had a pronounced impact on the faculty member's plans and consideration for technology integration. In fact, this type of sharing and opportunities for technology-related discourse were perhaps the most valuable component of the entire program.

Another important facet of the program was its flexibility. As previously stated, specific session topics were scheduled, however, the group frequently deviated from these planned topics. It did so to accommodate the needs and interests of the two methods faculty. For example, their curiosity regarding unique uses of PowerPoint required several sessions as opposed to the single session planned. The group decided that rather than rushing through a topic merely for the sake of covering it, its time would be better spent by providing more in-depth coverage of those topics perceived as most useful. They felt that they would rather walk away from this project with one good technology tool for classroom use instead of several superficial projects that would never be implemented.

In the final activity of the project, the three group members, using the NETS for teachers, discussed and developed course syllabi that contained specific NETS performance indicators. This culminating activity was very useful in that it allowed the two methods faculty to begin planning the implementation of their newly developed skills, knowledge, and ideas relevant to technology.

Conclusion

The results of this semester-long collaboration were that the selected methods faculty were better prepared to utilize technology as a tool for instruction in their own classrooms and to train their students/preservice teachers to utilize technology in their classrooms. Additionally, with the knowledge, skills, and confidence gained through the project, these educators can now serve as effective technology mentors to other faculty.

In addition to increased skills, knowledge, and attitudes regarding technology use, the project yielded many other more tangible outcomes. For example, both professors have now set up their own faculty web page, created and posted online materials for their courses using Blackboard.com, and have a variety of projects and presentations ready for implementation. These types of products will not only be useful in the immediate future, but will also promote the continued development and modeling of technology-based instructional tools. Perhaps the most gratifying outcome of the entire project, however, was that it simply provided time, incentive, and opportunity for those involved to think about and discuss technology use in the classroom.

State-wide Collaboration among Three PT3 Grant Recipients

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Abstract: The PT3 Utah consortium includes Brigham Young University, Utah State University, and Westminster College. It provides members with unique advantages: opportunity to be informed of each other's projects to the subsequent benefit of all; to share resources of local expertise and material assets; to strengthen inter-college activities through joint publications and presentations; and to help each other out when moments of challenge arise. The leaders hope to impact teacher preparation and technology use in schools across the state of Utah. This panel discussion will focus on areas of common interest, and how the collaboration has strengthened their work.

Introduction

Brigham Young University, Utah State University, and Westminster College have joined together collaboratively as they implement their PT3 grants. The leaders have discussed the similarities and differences in their grants, and have worked to support each other rather than duplicate effort. They hope to impact teacher preparation and technology use in schools across the state of Utah. This panel discussion will focus on areas of common interest, and how the collaboration has strengthened their work. Nancy Wentworth and Rodney Earle are co-principal investigators for the Brigham Young University

implementation grant. They are working to systemically restructure the Brigham Young University Teacher Education Program to meet the proposed NCATE Standards for technology in teacher preparation programs. The participants are working to design technology-rich curriculum for both the teacher education program and K-12 schools and the mentor BYU faculty and BYU students in the use of the technology-rich curriculum. Steven Soulier is the principal investigator for the Utah State Implementation Grant and Tim Smith is the co-director of the School for the Future at Utah State University. They are working to ensure a fully collaborative, technology-infused curriculum across 31 academic majors in five university departments. David Stokes is the director of the Westminster PT3 project. Wanda Carrasquillo is the project manager. After a year of working on a PT3 Capacity Building grant, Westminster has an implementation grant that will emphasize student participation in integrating technology into content courses, student teaching experiences and the first year of teaching. The ultimate goal is to turn Westminster College's 250 teacher candidates into active technology users and improve student achievement for K-12 students in the Jordan and Salt Lake school districts.

PT3 Grant of Brigham Young University

The purpose of Brigham Young University's implementation grant is to systemically restructure the teacher education program to meet the proposed NCATE Standards for technology in teacher preparation programs. This will require the design of technology-rich curriculum for both the teacher education program and K-12 schools and the mentoring of BYU faculty and BYU students in the use of the technology-rich curriculum. It will also require on-going collaboration of all participants in sharing successes in curriculum development and implementation. These goals are addressed through three major project activities: (1) creating design and mentoring teams, composed of university education faculty, content specific methods teachers, cooperating teachers, and instructional design and technology specialists who will simultaneously re-design our current teacher preparation curricula and public school K-12 curricula, (2) using teacher-student electronic networks (email listserves and website development) that will allow project participants to share newly developed curricula, and (3) holding yearly summer institutes focused on the infusion of technology into learning. These three activities are shaped by a philosophy that emphasizes curriculum integration, problem solving, data collection, information management, communications, presentations, and decision-making in teacher preparation and public school curriculum.

Design and Mentoring Teams

The McKay School of Education created design and mentoring teams of faculty and technology specialists to mentor undergraduate and graduate students in the development of K-12 curriculum that meets the National Education Technology Standards for Students (NETS). The NETS Project (1998) is an International Society for Technology in Education (ISTE) initiative funded by the U.S. Department of Education, the National Aeronautics and Space Administration (NASA), the Milken Exchange on Education Technology, and Apple Computer, Inc. The primary goal of the NETS project is to guide educational leaders in recognizing and addressing the essential conditions for effective us of technology to support PreK-12 education.

The first objective of the teams is to "plan and design effective learning environments and experiences supported by technology" (NETS Standard II). BYU student and faculty are examining Utah State K-12 Core Curriculum for lessons rich in uses of technology. BYU students and faculty are developing lessons for a McKay School of Education Webpage that meet the Utah State K-12 Core Curriculum and that "use technology to support learner-centered strategies" and "develop students' higher order skills and creativity" (NETS Standard III). BYU faculty and technology specialists are mentoring BYU students on how to evaluate the lessons based on the NETS standards. BYU undergraduate and graduate students will review each other's learning activities based on the NETS standards. As a result of the mentoring program BYU undergraduate and graduate students will produce 120 learning activities for the David O. McKay School of Education Curriculum Webpage that meet the NETS Standards.

The second objective or the teams is to help BYU students integrate technology into curriculum and instruction in the public schools. BYU students are implementing at least one technology-enhanced activity while they student teach in the public schools. With the help of a faculty and technology specialists

BYU students will produce an electronic portfolio of teaching with technology during their student-teaching experience. The technology specialists and graduate assistants will mentor them in this process. BYU graduate students are reviewing the electronic portfolios of undergraduate students based on the NETS standards. As a result of the design and mentoring program BYU students will produce 60 electronic portfolios of teaching with technology in a public school classroom.

The third objective is to mentor graduate students and undergraduate students in the research of technology on teaching and learning. Mentoring teams are defining research questions on the effects of technology on teaching and learning. Mentoring teams are collecting and analyzing data to answer the research questions on the effects of technology on teaching and learning. BYU undergraduate and graduate students have submitted research proposals on the integration of technology in curriculum to regional and national conferences including Northern Rocky Mountain Educational Research Association, Utah Association of Supervision and Curriculum Development, Society for Information Technology and Teacher Education, and International Society for Technology in Education. As a result of the mentoring program at least 10 BYU undergraduate and 6 graduate students will present at regional or national conferences.

Electronic Networks

All participants in the grant are being linked through listserves and websites to provide continuing support for the curriculum development and technology integration. Models for such websites have been drawn from other efforts around the country in which electronic dialogue complements classroom learning. Excellent website examples include The Utah Education Network Olympic site, http://www.uen.org/2002/, and the NASA Learning Technology site, http://learn.ivv.nasa.gov/. The teacher preparation program will include requirements of students to develop technology integrated curriculum that could be included on a refereed BYU problem-based learning website. BYU faculty can submit curriculum ideas and research on integrating technology into teacher preparation to the website. Teachers from around the country will be able to upload curriculum to a data base where technology specialists in the Partnership will review and select curriculum to be included on the site.

An ongoing network of teacher graduates from BYU will be created for further sharing of technology-rich curriculum. Approximately 100 BYU preservice teachers do their student teaching in the inner city of Washington, D.C, Mexico, the South Pacific, and China. The electronic network will connect them and their students to developed curriculum and to other students using technology in their classrooms. BYU will supply laptop computers to these sites.

Summer Institutes

Schools of education and public schools will draw upon the creative work of all design and mentoring teams as they bring technology integrated curriculum and cohort participants together. Summer institutes will provide an excellent environment for mentoring BYU faculty from one cohort to another and from one year to year. Students will learn from other students and faculty as they focus on effective approaches to technology integration in learning. Participants in the institutes will become part of the creative energy of the overall project as they work with mentors, especially Clinical Faculty Associates, to create their own inquiry-based approaches for their classrooms. The summer institute will involve all cohort participants in the teacher education program and will be extensions of the design teams. They will collaborate with project staff in pilot-testing newly designed instructional approaches. Nationally recognized leaders in technology integration, including Dr. Brian Page (Apple University Consortium) and Dr. Michael Connell (Society of Information Technology and Teacher Education), and Dr. LaMont Johnson (Editor, *Computers in the Schools*) will participate in the institutes. External evaluators will collect data from participants during this time.

PT3 Project at Utah State University

Steven Soulier is the principal investigator for the Utah State Implementation Grant and Tim Smith is the co-director of the School for the Future at Utah State University. They are working to ensure a

fully collaborative, technology-infused curriculum across 31 academic majors in five university departments. The consortium of participants at Utah State University is working to (1) establish a staff development plan to train teacher education faculty and give further support through a Teacher-Education Faculty Assistance Center; (2) create a standardized, online assessment tool to track student progress in meeting technology standards; (3) insure that the responsibility for meeting technology standards extends to the entire campus; (4) develop an online resource bank and an online, collaborative learning community; (5) use video conferencing to expose students to model K-12 classroom practices; (6) ensure the use of technology in student field experiences; (7) upgrade teaching stations; and (8) require students to document their technology skills in an electronic portfolio.

PT3 project at Westminster College: Content Methods Curriculum Revision

This project represents an instructional model designed to provide preservice teachers at Westminster College in Salt Lake City, more opportunities to integrate educational technology into all content areas during their teacher preparation program and first year of teaching. The project is a joint venture of a consortium comprising Bryant Intermediate, Clayton Middle, and Lincoln Elementary Schools from Salt Lake City School District, Majestic Elementary School from Jordan School District and Westminster College.

With current funds from a Capacity Building Grant, classroom teachers from one consortium school and faculty members who teach math and science methods formed a cohort to engage in collaborative curriculum development. Common hardware and software were purchased for both sites. New syllabi that incorporate the use of educational technology for the methods courses and school courses were designed and are being co-taught and revised through a formative evaluation process. The Implementation Grant extends the opportunities for the math/science cohort to do further curriculum revisions and allow all faculty members who teach language arts, creative arts, reading and social science methods to form similar cohorts with classroom teachers who teach these subjects in the three additional consortium schools.

The School of Education at Westminster College has placed preservice teachers at these consortium sites for several years. Many teachers in these schools serve as mentors during semesters of early field experiences as well as student teaching. The principals serve as a part of *Westminster's Local Partnership Oversight Committee* to examine existing and future collaborative initiatives among these sites and other partnership sites we are developing. Faculty at these consortium sites and Westminster College are coming to understand the power computer based technologies provide for achieving the goals of the cognitive movement in education. They know that skills and knowledge are too often taught out of context, as ends in themselves. To overcome this, there is a growing recognition that computer based technology and particularly multimedia bring to the classroom real-life examples and situations that provide the contextual framework so important to learning (Brown, Collins, & Duguid, 1989). Anchored instruction (The Cognition and Technology group at Vanderbilt, 1990), the capability to demonstrate real world applicability of knowledge, is less prevalent than hoped. Findings that suggest computer-based learning environments reduce learning time significantly (perhaps as much as 80%), and that achievement levels are more than a standard deviation higher (Kulik, et.al. 1991, 1985) have been largely ignored, if known.

As more understanding about how technology tools can distribute learning across persons and expand a more diverse group's capacity for innovation and invention, the need to explore the performance and pedagogical uses of technology are clear. Even though teacher education faculty and their students regularly discuss the role of social interaction in knowledge construction (Vygotsky, 1978), faculty feel there has been insufficient planning to ensure preservice teachers the opportunities to work with veteran teachers and together help K-12 students meet content standards through the use of instructional and learning technologies. At Westminster educational technology applications are formally presented in a required course for all teacher education students, but often the preservice teachers separate these applications from educational practice. Additionally the classrooms where preservice teachers complete their field experiences for content methods often do not have hardware and/or software which promotes application of strategies learned on campus. In short our preservice teachers tend to view what they learned on campus about educational technology as not relevant to the practical world of K-12 teaching when it is not integrated into the formal methods course work and related field experiences. The application of this grant was hoped to alleviate this problem.

Project design

After review of the recently completed Capacity Building Grant project to develop a new instructional model to improve the quality of teaching and learning in math and science methods with Bryant Intermediate School, the consortium set out to: 1) complete the instructional model that has been developed in math and science with Bryant Intermediate School; 2) extend the model to the content areas of Language Arts, Reading, Social Science and Creative Arts methods with 3 additional consortium schools (Clayton Middle School, Lincoln Elementary and Majestic Elementary). To bring this about the consortium developed a four phase project.

Year 1 (2000-2001)

The math/science cohort have moved into their second phase of continued curricular revisions in the science and math methods courses on campus and the science and math courses at Bryant Intermediate School. The model provided by this cohort will be replicated by language and creative arts faculty and consortium teachers. Each will in turn investigate technology as an instructional and learning mechanism and develop new technology enriched units for an extensive curriculum revision. While this is happening the math/science cohort will target the following as means to further integrate technology into their curriculum.

- Providing for a networked learning community; affordable configurations of portable computers and wireless connectivity
- Providing video-taping conferencing services so that preservice teachers will be able "sit in" on practicing teachers' classes
- Emphasize development of "Project Based" curriculum to integrate content
- Explore on-line courses
- Integrate more fully the technology enhanced components of special education and diversity into methods courses
- Provide preservice teachers with technology rich experiences in methods classes, field experiences and student teaching

Additionally during this phase funds provided by the grant permit a technology center designed specifically to the needs of the grant. With information technology support and expertise from the educational technology specialist in the School of Education, preservice teachers, faculty and partner teachers will have the means to move through phase one, to phases two and three. Each phase brings its own unique technology needs, from software particular to a method cohort, to vital online communication equipment allowing development of real time field project units. These needs are partly to be fulfilled by the creation of the technology center. The technology center will be: 1) a place for development of integrated technologies into curriculum; 2) for practice in teaching with technology; 3) an active classroom demonstrating technology enhanced curriculum; 4) a video-conferencing center; 5) a place where pedagogical and technological theories can be effected into learning; 6) a place where web based instruction will be developed.

Year 2 (2001-2002)

The math/science cohort will move to the third phase that includes teacher induction and supported use of the technology center. The language arts cohort and the creative arts cohort will move to the second phase which includes continued, focused curriculum revision, and the reading/social studies cohort will begin the first phase of the project to explore technology tools. The education technology center will continue to serve all the subject area cohort participants, preservice teachers and first year teachers.
The math/science cohort participants will make decisions about their continued work together. The grant funding will no longer support their time for curriculum revisions. To promote their continued dialogue and ability to access information that will continue to technologically enrich their curriculum and instruction, the cohort participants will be encouraged to use the technology center. The technology center will provide

instructional support staff services on a daily basis. Some of the services that they will provide are: 1) a place to test the effectiveness of curricular change; 2) technology staff support to help with additional curriculum changes; 3) a place that creates and sustains web pages that reflect the progress of consortium outcomes.

Year 3 (2002-2003)

The language arts cohort and creative arts cohort will move to the third phase with the math/science cohort who have already reached that phase. They will no longer have grant funding to support their time for curriculum revisions, but they will have access to the technology center for continued support. The reading/social studies cohort will move into the second phase for continued curriculum revisions.

Year 4 (2003-3004)

All consortium members will be in phase four of the project. This allows for continued mentoring of graduated first year teachers and provides access to the technology center which will continue to be funded by Westminster College.

Project activities to support goals

It is important to note that during the each phase of the project, every subject area cohort will impact approximately 500 students at a school site and 40 preservice teachers from Westminster College as they are actively involved with the methods courses and field experiences. At the end of the three-year period, all of the 250 preservice teachers at Westminster College will complete technology-enriched content methods courses and many will have enriched field experiences. Approximately 2000 K-12 students and their teachers will be working with our preservice teachers using technology enriched curriculum and instructional practices each year. Drawing upon multiple sources of information these future teachers should be able to:

- Promote real-world collaborative inquiry
- Attend to multiple learning styles
- Explore content applications related to standards and the core curriculum
- Use media in new assessment models that enable educators to assess the application of learned skills and concepts in authentic settings
- Develop multimedia portfolios
- Create web based learning experiences
- Use modeling and simulations as teaching strategies
- Extend the power of inquiry-based learning, and multiple forms of reasoning through content-based activities that utilize various appropriate technologies (e.g. use of field microscopes, probes, graphing calculators, computers, e-mail).

Conclusion

Math and science faculty through the Capacity Grant experience have found their perspectives of teaching and learning to be fundamentally changed. Using KaleidoMania and Shapemakers, Geometers Sketchpad, video microscopes, along with virtual labs has demonstrated student engagement and learning. Technology applications are now clearly understood to allow students multi-tasking capabilities as they engage in real work oriented projects. Math and science faculty now look to technology as a means "not to an answer but a way to find answers." And further, "Every time we create an integrated unit in our methods courses, we now look for a way to incorporate a piece of technology to add depth to understanding and create questions. As an example, because of our use of the CBL to measure the rebound of a [bounced]

ball, we have more questions to ask about the graphing of data". Math and science syllabi now reflect this change. It is our expectation that similar changes will take place in other content areas.

The project remains on track to effect lasting substantive change in ways school of education faculty, preservice teachers, and consortium teacher participants view technology applications for the acquisition of knowledge, teaching and probably professional lifestyle. Evaluations as they progress are expected to bring rich data to the fore useful in the form of technology rich teaching units, assessment methods congruent to this new mode of teaching and learning, and perhaps a handy prescriptive record of changing faculty views towards technology for teaching.

Summary

The organization of the PT3 Utah consortium provides each member with unique advantages. These include: opportunity to be informed of each other's projects to the subsequent benefit of all; to share resources of local expertise and material assets; to strengthen inter-college activities through joint publications and presentations; and to help each other out when moments of challenge arise.

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The Implementation of Change in Technology Rich K-8 Classrooms

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Abstract: This qualitative study reports on the Arizona Classrooms of Tomorrow Today project, a component of a Preparing Tomorrow's Teachers to Use Technology project. In conjunction with five partner school districts, Arizona State University West developed five technology-rich K-8 classrooms that serve as models for preservice students and university instructors. This study reports on the changes occurring as the AZCOTT teachers learn to teach in technology rich classrooms. Changes were described in teacher practices, student attitudes, and classroom management. Generally, the researchers found that technology has become an integral part of each classroom. Factors contributing to implementing change in these classrooms are discussed. The researchers also discuss the progress made toward using these classrooms as models for preservice students.

Introduction

Buying technology for K-12 classrooms is expensive, but a relatively straightforward procedure. Much more difficult is changing the way teachers teach so that they use technology effectively. This is one purpose of the Arizona Classrooms of Tomorrow Today (AZCOTT) project, a component of Arizona State University West' Preparing Tomorrow's Teachers to Use Technology Project (PT3).

Educational changes can involve products such as computers or processes such as constructivist teaching. Also, change often is not centered on one innovation but many (Hall & Hord 2001). Similarly, Fullan (1991) describes three components to the implementation of change: (a) the possible use of new or revised materials, (b) the possible use of new teaching approaches, and (c) the possible alternation of pedagogical beliefs. The three aspects are necessary because together they represent the means of achieving a goal. In this study the authors will describe changes occurring as experienced elementary teachers learn to teach in technology rich classrooms.

Another purpose of the AZCOTT program is to improve the preparation of preservice students to integrate technology in their future classrooms by inviting their university instructors to participate in the AZCOTT training because they in turn encourage their students to visit and participate in the AZCOTT classrooms.

Program Description

In conjunction with five partner school districts, ASU West developed five technology-rich K-8 classrooms that serve as models for preservice students and district teachers. Five college of education instructors participated in at least two days of the AZCOTT training along with the K-8 teachers. These instructors as well as the student placement coordinators encouraged preservice students to observe in and select these classrooms for practicum experiences.

AZCOTT teachers were selected based on their answers to key questions about potential student use of technology in the classroom. In January 2000, children began participating in five Arizona Classrooms of Tomorrow Today (AZCOTT). In addition to the technology already in their classrooms, these teachers have received 4-5 multimedia computers with Internet access, software, some type of projection system, and

technical support from our school district partners, and they have received more than 100 hours of training from the PT3 project.

The Spring semester and summer training consisted of an initial two day workshop followed by four half days of training throughout the semester and three days in June. The curriculum addressed new technologies and creating and implementing the curricular units called Units of Practice (UOP) (Sandholtz, Ringstaff, & Dwyer 1997) that integrated technology into elementary content areas. Participant's UOPs and the rubric can be viewed at www.west.asu.edu/pt3. Time was also provided to share ideas and reflect on practice. Between sessions, participants communicated using an on-line conference. The second semester of training began in September 2000 and consisted of every other month half-day meetings and participation in a graduate course on using the Internet in the classroom.

Methodology

Using qualitative techniques, the authors describe changes resulting from the teachers' participation in the AZCOTT program.

Subjects

Five teachers, one from each school district that is a university partner, were selected to participate in the first cohort of the AZCOTT program. These teachers were initially selected because it was thought that they would provide exemplary models of technology integration for preservice teachers and district teachers. A brief description of each classroom follows.

Mr. B taught 27-second grade English as a Second Language learners in an urban inner city school where all of the students are receiving free or reduced lunches. His students stay with him for two years beginning with second grade. He has been teaching for 4 years and is a technology mentor for his school. As a technology mentor he helps other teachers with technology before and after school.

Ms. Lo taught 120 sixth graders science and language arts in an urban school with 35% of students receiving free or reduced lunch. She was a technology mentor for her school.

Ms. T taught 110 seventh graders mathematics and pre-algebra. Fourteen percent of these students were receiving free or reduced lunch.

Ms. Li taught 31 fourth graders in an urban elementary school with 50 percent receiving free or reduced lunch. She is a technology mentor for her school.

Ms. V Taught 100 seventh- and eighth-grade, gifted students in urban schools with few students receiving free or reduced lunch.

Data Collection

The data for the study came from multiple sources. First, during the AZCOTT workshops participants shared their questions, concerns, curricular ideas, and implementation attempts. These teacher reflections and discussions were audio or videotaped and transcribed. In addition participants participated in a FirstClass on-line conference that provided support as they implemented technology use in their classrooms. Between each workshop session participants used this on-line conference to react to a chapter in *Teaching with Technology* (Sandholtz, Ringstaff, & Dwyer 1997) often comparing their situations to those described in the chapter. These messages were aggregated using a summarize feature of FirstClass, printed and analyzed. Also an external evaluator visited several classrooms and collected data as he observed in the classrooms and interviewed the teachers. The external evaluator submitted a report summarizing his findings. Additional data sources were video vignettes taken in each classroom of the AZCOTT teacher and students, and the impressions of the PT3 project manager who visited each classroom and took notes on her visits.

Data Analysis

Using the constant comparative method (Strauss 1987), data analysis began as data were first collected and continued throughout the study. The first and second authors independently read the transcripts and on-line conference printouts and identified patterns and categories. Subsequently they met to discuss patterns they observed in the data and questions that arose after the readings.

After collecting this data, the authors re-read all the transcripts and re-categorized the data. Each highlighted the portions of the transcripts addressing each category. They met to compare the answers to the questions and the categories that arose as they read. Then they compared key categories and re-read the transcripts to see if the selected categories worked to describe the experiences of the AZCOTT teachers. The themes that emerged were: teacher change, student change, classroom change, and school change.

Results

The data from selected aspects of the themes (teacher change, classroom change, student change) will be reported in this section.

Teacher Change

The researchers found the following types of teacher changes: changes in teaching methods, curriculum (UOP), and teacher leadership. Changes in teaching methods will be discussed below.

Changes in Teaching Methods

As teachers became involved in the training, workshop reading and sharing with peers, they questioned their approaches to teaching. For example:

"What AZCOTT is forcing me to do is to look beyond what is comfortable and ask where and if my current practices fit and if they don't what can I do to alter them so that they do fit. It is a very reflective practice that can be a little scary. I try to accept that I may not have all the answers and hope that I am flexible enough to accept any needed changes." (March 9 Online Discussion, Ms. T Gr. 7 math)

Changes in teaching methods included movement from a teacher-oriented approach to other approaches that involved student collaboration. A teacher explains,

"Instead of doing a lecture where I used to stand there and just give them scads of notes and they would all walk out grumbling, I give them the study guide research sheets and in groups they work to find the answers using the [computer] program. (March 11 Discussion, Ms. Lo Gr. 6 science)

Classroom Change

The researchers found changes in the area of classroom management, student engagement, and levels of classroom noise. Using the actual words of teachers, student engagement and noise levels are discussed below.

Student Engagement

AZCOTT teachers arranged for students to help each other and describe students working together within the context of projects that captivate their attention. For example:

"Today I was watching students working in all corners of the room. While I was helping one (group of) students edit their animal report, I looked around and everyone was busy, helping each other with typing, getting ideas synthesized into paragraphs or finishing up poems and drawings for their reports. There was plenty of activity and noise, but everyone was on task." (February 25 Online Discussion, Ms. Li Gr. 4)

"I have students now getting involved that were not before." (February 25 Online Discussion, Ms. Li. Gr. 4)

"I see 110 seventh graders comfortable working with each other . . .. They became the experts. Collaboration was amazing between them. . . .They are willing to take risks. They are on-task, engaged." (April 29 Workshop Sharing,, Ms. T Gr. 7th math)

Noise Levels

However, with the student engagement and conversations, there was also a general unease over the amount of noise in their classrooms. For example:

". . . I now see the value of students sharing. My classroom is noisier." (April 29 Workshop Sharing, Ms. Li Gr. 4)

"It's a tremendous amount of conversation. The noise level is always up. I don't have a problem with that. It bothers some of my colleagues, so I have to deal with that, and I do." (February 26 Discussion, Ms. T Gr. 7 math

"I feel I'm heading in the right direction. My kids are younger, so self control is hard for them. The noise level grows and the kids will argue. I'm having to get used to this. I get impatient." (April 29 Workshop Sharing, Mr. B Gr. 2-3 looping)

Student Change

Student changes were noted in the areas of student learning, student attitudes, student collaboration, and students as helpers. Student attitudes in regard to collaboration and helping are discussed below.

Student Attitudes

AZCOTT teachers discussed attitudes students acquired that illustrate their disposition toward learning and helping others. For example:

"Students come up with ideas on how to use the laptops and software (Inspiration). They always go beyond what I asked them to do." (Workshop Sharing May 20, Ms. Lo. Gr. 6)

"Already the kids have said, "Well, you know, can we stay after school sometimes and do the extra work?" (Workshop Sharing, Sept. 23, Ms. Lo Gr. 6)

"The biggest impact has been socially. It has allowed them to do projects for other teachers and they are now role models . . . last year my students helped build the school web site . . . this year I don't have time to maintain that. Two of my students called me during the summer and asked me for a letter of recommendation to take a college course on programming. I approached them at the beginning of the year and I said do you want to be the web masters. How would you like to maintain the web site? It is already built and talk to the new teachers on campus and . . . coach some teachers along on how to build their own web pages . . . They are thrilled to death those two kids . . . even though I am not there, they are . . . talking to teachers now and giving them suggestions for getting them set up. That's very exciting for me to empower students to take a technology lead at the school and sort of model that. . . ." (Workshop Sharing, Sept. 23, Ms. V Gr. 7-8 gifted)

Discussion and Implications

In this study we found change occurring in areas that are similar to those discussed by Fullan (1991): new teaching approaches, new or revised materials, and the alternation of pedagogical beliefs. Aspects of each of these areas are discussed below.

Teaching Changes

The regular AZCOTT meetings provided time for teachers to learn new technologies, design lessons, share ideas, and reflect on their teaching approaches. Often the participants noted changes in their approaches

to teaching that were less lecture oriented, more project oriented, more collaborative allowing students to work in small groups, and more collegial in that students became experts and worked with other students and teachers.

Curriculum Development

Teachers created curricular plans (Units of Practice) and implemented them. The workshops were effective in helping the participants prepare their Units of Practice. At the conclusion of each workshop day participants completed evaluations called exit tickets. These comments exemplify the value of the training:

"Collaborative/sharing set-up was extremely helpful and useful."

"We (as a group) have so much to say—we should (as a group) try to use FirstClass more to share all these great ideas and focus more on the topic at hand."

""Just speaking for myself, I would like to have our Saturdays be longer, perhaps six hours. I would use the extra time to work with my group on our project."

All teachers appreciated the training provided by the AZCOTT program. It helped them think about all of the components of a planned learning activity and thus prepared them to implement the integration of technology in their curriculum.

Student Engagement

Across the classrooms, we found positive changes in student engagement. Teachers noted that students were excited about learning. They displayed initiative by going beyond the assignment and by asking to use computers during free-time and after school. We also found general teacher concerns about noise levels in their classrooms or at least the beliefs that others would find the noise levels in their classrooms inappropriate. First it should be noted that these AZCOTT teachers had been in the program for only one year and were learning new classroom management techniques needed to organize student use of the added technology. Second the noise that accompanies student engagement may be a good problem, but it also was a real issue that continues to be on the minds of the participants.

Student Learning

Teachers described many forms of student learning from students doing better on tests to the students with difficulties who were able to learn more than before. Examples of the later included improved students writing, improved comprehension by deaf students, and improved relations among emotionally handicapped students in part because they brought technology expertise to their groups and other students wanted to participate with them.

Teacher Leadership

Initially when this group of teachers applied to become AZCOTT teachers, the school district and university partners looked for candidates who would be leaders in their schools. It is quite clear that these teachers were taking what they had learned and sharing it with other teachers. They teach after school technology classes and often assist their peers to solve technology-related problems. This was primarily evident at the school level, but it also occurred at the district level. For example, at a district technology staff development event, the superintendent of a school district with an AZCOTT classroom remarked "What a difference Ms. T's room has made to the district" and said they would find teacher substitutes for those wishing to visit and participate in that classroom. In another district, one teacher was selected to become a district technology integration specialist as well as continue teaching a section of her grade 7-8 gifted class.

Beginning Preservice Participation

One of the disappointments of these teachers is that more ASU West student teachers and practicum students hadn't visited and participated in their classrooms. They expressed the hope that they would be able to provide models for them and inspire them too. It should be noted that the PT3 project leadership, now in the second semester of the project, is aware of this issue and is working on marketing strategies. One unexpected outcome of the project is that each AZCOTT teacher has been invited to talk to preservice students as part of their university courses or workshops and share scenes from their classrooms through videotaped vignettes. Recently, an AZCOTT teacher took part in early childhood workshop for preservice students. After the workshop the students were asked to complete evaluation questions. They found the AZCOTT teacher sharing helpful and requested additional opportunities to dialog with other AZCOTT teachers.

What Worked?

It appears that technology has become an integral part of each classroom rather than a time set aside to go to the computer lab 40 minutes a week. We think this early success is due to the project's ability to address multiple interventions. Hall and Hord (2001) point out that change often is not centered on one innovation but many. In this case AZCOTT teachers had the support of their principals, participated in over 100 hours of high quality workshop training distributed over the course of a year, attended two local educational technology conferences, received technical support from their school districts, benefited from online support through interactions with their peers and PT3 project staff, enjoyed technical and curricular support from the project manager and her site visits, and received adequate access to technology and the internet. Additionally, the teachers were selected because they were experienced teachers who were interested in constructivist philosophies associated with active student participation, collaborative workgroups, and meaningful projects. Although we noted signs of early success, experts on the change process have found that the implementation of change often requires 3-5 years (Fullan, 1991; Hall & Hord, 2001). We plan to revisit these classrooms after the second and third years of the project and trace the developments of the teachers and the preservice students influenced by the AZCOTT classroom examples.

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Helping Higher Education Faculty Model Use and Integration of Technology in Teaching

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Abstract: A large-scale faculty development project focused on the integration of technology for teaching and learning in Marquette University's Colleges of Letters and Science, Communication and School of Education is described. The project includes 1) a website with multiple resources to help faculty integrate technology into their teaching 2) faculty consultants for technology planning; 3) "just in time" support; 4) workshops that promote technology integration for learning 5) mini-grants for course redesign.

Despite the explosion of technology in schools as well as the huge volume of knowledge available electronically, most teachers still use a limited number of technological tools in fairly traditional ways. In a recent survey on technology use in classrooms (Milken Exchange on Educational Technology, 1999), for example, it was found that typically teachers use video to present information and computers for basic skills practice and word processing. Newer technologies like desktop publishing, computer simulations, multimedia projects, videoconferencing, electronic chats, and electronic information gathering are much more rarely used (Office of Technological Assessment, 1995) even though these technologies offer great potential to enhance student engagement and achievement (O'Neil, 1995; Tharp, Estrada, Dalton & Yamauchi, 2000).

Numerous studies of technology in teacher preparation point out that future teachers cannot learn how to use and integrate technology effectively in a single course. They need a technology-infused program that involves not only entire schools of education but faculty in the humanities and sciences who can collectively model technology integration for future teachers. For this reason, we have begun a long-range faculty development effort at Marquette University that focuses on 1) helping professors in arts and sciences, communication as well as education integrate technology into their instruction to improve student learning and 2) expanding leadership roles among faculty to model and mentor integration of multiple technological tools into student-centered instruction.

Currently, this staff development program includes: 1) a website with multiple resources to help faculty integrate technology into their teaching 2) faculty consultants for technology planning; 3) "just in time" support; 4) workshops that promote technology integration for learning 5) mini-grants for course redesign.

Faculty Website

The goal of this recently launched faculty website has been to create an ongoing, dynamic, web-based educational portal for university faculty that will include online tutorials, listservs and online discussion forums; examples of faculty technology integration projects; and links to web resources for curriculum design and pedagogy that integrates technology. Current and planned tutorials on the website include how to integrate electronic data bases, e-mail, desktop publishing, presentation managers, multimedia, electronic portfolios, videoconferencing, computer conferencing, the Internet, digital and video cameras, and assistive technologies into teaching and assessments. After reading and discussing articles on the application of constructivist and brain-based learning principles into teaching, professors taking the

tutorials are expected to experiment with the integration of the technology in a course and use both faculty consultants and a faculty listserv for support and discussion about the technology. Currently, for example, the faculty listserv includes faculty members who teach courses in the arts and sciences as well as courses in education who are implementing the use of Blackboard, an online courseware package, into their courses.

Faculty Consultants For Technology Planning

Two full time faculty consultants lend their technical expertise to help faculty members identify and acquire the technology they need to meet educational objectives. The Learning Technology Consultant helps faculty members address instructional design and curriculum integration issues and the Technology Coordinator helps faculty members address and troubleshoot all of the technical issues related to the particular hardware or software technology they are trying to implement. For example, currently two professors in the Foreign Language Department are designing a project for their Spanish History course which requires students to create a multimedia presentation. They needed advice on both the purchase of a multimedia workstation as well as various curricular aspects of the project. Both of the consultants met with the professors to determine their needs and were able to recommend the purchase of necessary hardware and software with very detailed information about specifications. At other times, technology planning involves making mid to long-range decisions about how existing curriculum may be improved through the integration of educational technology. In such a situation a faculty member and the Learning Technology Consultant can combine their expertise in both content and technology to make decisions about integrating technology in the curriculum in ways that improve learning. For example, an Education professor had used journals to encourage students to reflect on their impressions of schools they were visiting. In an attempt to enhance the effectiveness of this course requirement, the professor sought a technological solution that would allow students to share their experiences and reflections with other students in the class. The Learning Technology Consultant was able to suggest a number of web-based applications such as e-mail, threaded discussions and discussion boards and explain the pros and cons of each. Given the situation, the professor was then able to determine that the discussion board would work best in supporting the particular educational objective.

Just in Time Support

When the integration of technology is used to enhance the learning experience, even more preparation time is required to schedule and set up equipment or to create multimedia or digital presentations. "Just in time" customized faculty support provides the resources necessary to integrate technology into a learning experience on short notice (Oblinger, 1998). The Learning Technology Consultant is available on-demand to provide strategies and guidance for technology use that support learning objectives and the Technology Coordinator is able to allocate and set up necessary equipment just in time for class. In short, just in time support, with its commitment of personnel and equipment, facilitates the serendipitous use of educational technology.

Workshops

In addition to the wide range of technology knowledge and use among faculty at Marquette, there is also a wide range of how faculty thinks about teaching and learning and how technology can be used to enhance particular paradigms of teaching and learning. For example, one teacher who sees teaching as largely the transmission of information might use PowerPoint to build better lectures, while another teacher who subscribes to a more constructivist (Driscoll, 2000; Perkins, 1991) view of teaching and learning might offer students the opportunity to use PowerPoint to share and engage others in what they have learned.

Based on faculty interest, the Learning Technology Consultant has been conducting workshops for small groups of faculty on technology topics that go beyond a purely "how to use" approach. Workshops promote the use of technologies like PowerPoint and web pages to create complex learning environments with activities that are relevant to the learner (Driscoll, 2000), ample opportunity for social negotiation of meaning (Persichitte, Caffarella & Tharp, 1999; Vygotsky, 1978), multiple ways to learn (Gardner, 1983), metacognition (Duffy & Cunningham, 1996) and student-directed learning (Perkins, 1991).

Mini-Grants for Course Redesign

Over a three year period (2000-2003) faculty members in the Colleges of Arts and Sciences and Communication as well as the School of Education will be given the opportunity to apply for summer mini-grants as an incentive to redesign a course in a way that models the use of technology to support teaching and learning. To obtain the grant, faculty members are required to submit a proposal that presents a significant plan for technology infusion in a course that they teach to future teachers; demonstrate interest and involvement in technology; and explain how the revised course will model good teaching and learning principles. Currently, faculty members in Biology, Chemistry, Physics, English, Mathematics, Communication, Foreign Languages, Philosophy, Theology and Education are using these grants to revise their courses.

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Technology Integration in K-12 Classrooms: Evaluating Teachers' Dispositions, Knowledge, and Abilities

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Abstract. As part of the evaluation of PT3 sponsored technology integration workshops conducted at Arizona State University West, a Likert-type questionnaire was developed to collect information about teachers' beliefs and skill levels related to technology integration. This presentation will include a description of the questionnaire that is being used to collect pre-test and post-test data from preservice and inservice teachers. The instrument contains several subscales targeting teachers' perceptions of their confidence and skill level for using technology, knowledge of technology standards and the Unit of Practice (UOP), and beliefs about the best use and effects of technology integration. The focus of the presentation will then shift to the results obtained from its first administration. Quantitative results and conclusions about the effects of the technology training are presented.

Introduction

Background

In the PT3 grant developed at Arizona State University West, we devised three separate, but related components. First, we devised a professional development component, which focuses on university faculty development. Second, in partnership with local school districts, we established model technology-using classrooms, which our students and local teachers can visit to observe high-level technology use and integration. Third, and the focus of this paper, we included a professional development component for inservice, mentor teachers and preservice teachers who work together in field experiences and student teaching. We believe the third component is critical for ensuring that students in our programs see and have opportunities to employ technology in classroom settings as they proceed through our program. These initial experiences and opportunities to see and use technology are critical to subsequent use of technology because future educators are influenced by what they observe in practicum classrooms or by their own school memories (Darling-Hammond, 1995, 1998).

Rationale/Need

Advances in teaching expectations outlined by various professional organizations, which require teachers to integrate curriculum and incorporate technology into instruction attest to the continuing need for professional development (AAAS, 1993; NCTM, 2000; NRC, 1996; Thomas [NCATE], 1995; Wiebe & Taylor [ISTE], 1997). For example, NCTM (2000) guidelines prescribe hands-on, student-centered teaching and authentic, performance-based, instruction-driven assessment. Similarly, AAAS's (1993) *Benchmarks* stipulates both the content and the nature of instruction that are to be employed in science learning. Because both require a substantial focus on problem solving and active participation by students, meeting these guidelines will require substantial professional development.

Finally the need for professional development is particularly substantial when one considers the issue of integrating technology into current instructional endeavors. Thomas (1995) and Wiebe and Taylor (1997) have written extensively about the integration of technology into instruction. In their presentation of the revised ISTE Standards, Wiebe and Taylor (1997, p. 7) discuss the importance of technology integration when they state, "candidates will apply computers and related technologies to support instruction in their

grade level and subject areas. They must plan and deliver instructional units that integrate a variety of software, applications, and learning tools."

Although such mandates ultimately will prove to benefit students, inservice teachers are not currently prepared to meet the mandates. For example, research summarized by the United States Congress, Office of Technology Assessment report (USCOTA, 1995) indicates teachers are not prepared to integrate technology into instruction. More recently, the CEO Forum's *School technology and readiness report: Year 2* builds a strong case for providing additional professional development for inservice teachers so they can use technology more effectively during instruction (CEO Forum, 1999).

Method

Subjects

Participants (N = 21) consisted of two groups, 13 university students who were completing their professional education preparation program as student teachers and 8 inservice teachers. The majority of students were in Elementary Education programs including Elementary, Bilingual, ESL, and Early Childhood Education. The inservice teachers had been teaching 13.4 years on average. The eight inservice teachers were serving as mentors to eight of the student teachers.

Technology Questionnaire

A 42-item questionnaire, which assessed teachers' beliefs and skill levels related to technology use and technology integration was developed. Respondents rated each item on a 6-point Likert scale, where 1= strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, and 6=strongly agree. Higher scores indicated greater skill or more positive attitude. Examples of items follow. "I can develop lessons that integrate the use of video, digital cameras, or scanners." "I can use the National Educational Technology Standards (NETS) to design instruction." "Computers are an integral part of classroom instruction." In addition, one open-ended item assessed participants' "vision" for using technology by asking, "Over the next five years, how do you see yourself using technology in your classroom?"

The questionnaire was based on one developed for the Interactive Video Project (Wetzel, Zambo, Buss, & Arbaugh, 1996). In that study, the researchers developed a technology questionnaire to evaluate preservice students' preparation to teach with technology. For the present study, that questionnaire was revised to: (a) reflect the recent National Education Technology Standards for Teachers (ISTE, 2000); (b) ensure appropriateness for both preservice and inservice teachers; and (c) include items which assessed participants' knowledge and beliefs about the Unit of Practice (UOP) and the integration of technology.

Items were developed to provide coherent sets, which formed subscales that could be more readily analyzed. Twelve subscales were developed including: general confidence in using technology, confidence in computer setup and general operation, confidence in using non-computer equipment, confidence with software selection and use, confidence in addressing students with particular needs, confidence in developing lessons with technology, beliefs about appropriate use of computers, beliefs that computers are integral to classroom instruction, perceived cost effectiveness of computer integration, knowledge and beliefs about the technology standards, knowledge and beliefs about UOP, and level of technology use observed in university courses. In addition, a total questionnaire test score was computed.

Procedure

Participants completed the questionnaire on two occasions. They initially completed it in January 2000 prior to their participation in a set of workshops (18 hours of workshop and follow-up meetings) delivered to increase participants' skills in using technology and integrating it into the classroom setting. Participants

completed it a second time in May 2000. For the students, this administration followed the completion of their student teaching semester.

Workshops consisted of learning about the Unit of Practice and using it as a basis for developing a curricular unit, which integrated technology, and which was implemented during the student teaching experience. In addition, other topics addressed by the workshops included: National and State Standards for content areas including technology, Website evaluation strategies, school district resources, internet resources, preview of various software and video discs, use of the digital cameras, use of PowerPoint for presentations, and management techniques for limited computer classrooms.

Results

Using pre-test data, Cronbach's alpha for the total test was .93. Individual subscale alphas, with the exception of one outlier ($\alpha = .55$), ranged from $\alpha = .69$ to $\alpha = .90$ with a median of .81.

Results showed mean scores were relatively high for all subscales, both pre-test and post-test, generally ranging from 3.8 to 5.0 out of 6. There were significant between-subjects differences for group (student teachers vs. inservice teachers) and significant within-subjects differences for time-of-testing (pre- vs. post-test) for subscale and total test scores.

Differences in group (student teachers vs. inservice teachers) scores were noted for two variables. The effect for group was significant for knowledge and beliefs about UOP, $F(1, 19) = 4.59, p < .045$. Teachers, $M = 5.32$, felt more positively disposed toward the UOP and its benefits for instruction than were student teachers, $M = 4.80$. Moreover, the effect for group was significant for level of technology use observed in university courses, $F(1, 19) = 38.65, p < .001$. Student teachers, $M = 3.79$, indicated they had observed more use of technology in university classes than their inservice counterparts, $M = 1.43$.

Mixed ANOVAs indicated three subscale scores increased significantly from initial testing, prior to the workshop, to testing at the end of the semester. Confidence in using non-computer equipment such as laser disc players, digital cameras, capturing video, etc. increased significantly, $F(1, 19) = 6.70, p < .018$. Means for the two times of testing were 4.06 and 4.44. Similarly, confidence with software selection and use increased significantly, $F(1, 19) = 6.15, p < .023$. The pre-test mean was 4.25 and the post-test mean was 4.72. Confidence in addressing students with particular needs (i.e., second language learners and students with special needs) increased significantly, $F(1, 19) = 15.93, p < .001$. Means for the two times of testing were 3.87 and 4.71. Finally, there was a significant difference on the total test score for the initial as compared to the final administration, $F(1, 19) = 5.82, p < .026$. Mean item scores for the total test score were 3.81 and 4.06 for the initial and final time-of-testing, respectively.

Participants' pre- and post-test vision statements were analyzed to determine whether changes occurred. Fifty percent of the participants exhibited a post-test vision statement that demonstrated a higher degree of technology integration compared to their pre-test vision about the integration of technology. For example one participant provided the following pre-test and post-test responses, respectively: "I do not see myself designing lessons with technology in mind..." and "I would like to use technology on a regular basis as a method of teaching in my classroom. I would also use technology as a resource for information for my students."

Discussion

Results showed that the overall questionnaire was reliable. Further, the subscales, which were developed to assess specific areas related to technology use, technology attitudes, technology integration, and so on, were consistent and coherent as demonstrated by the strong reliabilities. The subscales allowed the researchers to explore components of technology use and integration with a greater level of specificity.

Such specificity provides a more detailed view of inservice and preservice teachers' beliefs, attitudes, and skills regarding technology use and integration.

Group differences were apparent on the subscale for the Unit of Practice. Teachers were more positively disposed to the UOP and its benefits for instruction compared to students. This may be attributable to the fact that the experience of inservice teachers provides them with a greater knowledge of planning at the long-term, unit level; whereas, relatively inexperienced, preservice teachers may be operating on a short-term, day-to-day basis. Moreover the effect for group was significant for level of technology use observed in university courses. This is not surprising, given that the inservice teachers who had been teaching on average 13.4 years, would not have observed substantial levels of technology in their coursework.

Significant increases occurred in confidence using non-computer equipment, confidence in software selection and use, and confidence in addressing students with particular needs. These increases could be attributed to three factors. First, participants were provided with opportunities during the workshops to learn about technology materials related to these three areas, for example, specific training was provided on the use of non-computer equipment such as video discs and digital cameras. Second, this new knowledge was directly applicable to classroom settings, as a result participants tended to incorporate this new knowledge and adapt it to their specific needs as they developed their UOPs. Third, students and their mentors had the opportunity to put into practice their new knowledge during the student teaching semester as they implemented their UOPs. Consistent with the professional development literature, opportunities to learn, adapt, and implement technology innovations are essential to fostering change and to promoting the integration of technology in classroom settings.

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Problems and Pitfalls of Directing a PT3 Grant

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In June 2000, President Clinton announced the award of $43 million to fund 122 new grants to train future teachers to use technology effectively in the classroom. These PT3 grants (Preparing Tomorrow's Teachers to Use Technology) are to be administered by the U. S. Department of Education. James Madison University will receive $493,554 over a three-year period to produce 36 digital video units that will eventually be placed on the World Wide Web.

This presentation will follow this project from initial writing of the grant, through organization of the personnel tapped to participate in the production of the digital video units to the production of the learning activities that will be placed on the Web. Various problems encountered by the project director while working with the various individuals will also be summarized.

Three school divisions from the Harrisonburg City/Rockingham County area have contributed nine elementary school teachers to work on teams, led by four faculty members from the JMU Early Education Program. One of the nine teachers will work with the JMU Center for Assessment and Research Studies to design and implement assessment rubrics to be applied to each of the 36 instructional units. Central to this assessment will be the National Educational Technology Standards for Students and for Teachers. At the local level (i.e., Virginia) assessment standards will include the Virginia Technology Standards for Instructional Personnel and the Virginia Standards of Learning. We believe these web-based video models can serve not only Virginia educators, but also pre-service teachers and teacher preparation faculty throughout the US and beyond.

This presentation will include examples of the video units produced to-date as well as "out takes" to demonstrate the challenges of videotaping students in the elementary classroom.

Collaborative Action Communities for Preservice Technology Integration

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Abstract: With a successful field-based preservice program aimed at effective strategies for teaching diverse urban youth, the University of Houston is implementing an action research process to actively collaborate with area school districts to establish networked learning communities of university faculty, preservice teachers, and school-based educators to support the development of future teachers. The College has restructured its required 1 semester, 3-credit-hour technology course to a series of 3, 1-credit-hour technology sections tied directly to methods courses to allow students to develop appropriate content methods-based technology proficiencies based on ISTE standards. To ensure that all members of our learning community are effectively prepared for appropriate inclusion of technology in content methods courses, faculty and students participate in a comprehensive support model of classroom instruction, workshops, and field-based experiences with the aid of a cadre of trained Technology Fellows.

Educators involved with the preparation of new teachers throughout the final decade of the Twentieth Century have repeatedly recognized the need for a strong technology component for preservice programs. They have experimented with a variety of learning models that integrated technology (Falba et al., 1999; Willis, 1997). While some successful projects have been implemented, there is agreement that new teachers are generally not being prepared to effectively integrate technology into their future classrooms (Office of Technology Assessment, 1995; Strudler, Quinn, McKinney, & Jones, 1995). It is no longer enough to prepare new teachers only with one disconnected technology-in-education course; introductory courses should instead be project-based and meaningful, followed by appropriate modeling and use in content methods courses and field experience. True modeling of how objectives can be accomplished by using technology for instruction is rare in preservice programs (Office of Technology Assessment, 1995). Professional development opportunities are needed for College of Education faculty to effectively integrate relevant technology use into their curriculum strategies and content standards (Office of Technology Assessment, 1995; O'Bannon, Matthew, & Thomas, 1998; Sprague, Kopfman, & Dorsey, 1998). Preservice teachers want to learn strategies for integrating technology tools into their teaching (Oliver, 1994), and expect to use computers in their teaching (Marcinkiewicz & Wittman, 1995) but express their feelings of frustration at their lack of technology proficiency (Francis-Pelton & Pelton, 1996) and a lack of understanding of effective technology use in contemporary classrooms (Balli, Wright, & Foster, 1997).

The Twenty-first Century finds us poised for widespread, concerted action on the subject of effectively preparing future teachers as complete professionals who are able to adeptly use and integrate into the curriculum all available learning tools. State and national organizations are leading the accountability push by implementing standards for the use of technology by teachers (Handler & Strudler, 1997; Wiebe & Taylor, 1997). In 2000, the International Society for Technology in Education (ISTE) brought this trend to a culmination with the release the National Educational Technology Standards for Teachers (NETS•T), a blueprint for the design of preservice technology programs developed through the extended collaboration of representatives from various stakeholder groups with interests in how new teachers use technology (Thomas, 2000). As this standards-based movement brings a clearer vision to the preparation of preservice teachers, teacher education programs across the country must finally acknowledge the long trend of research findings and recommendations in order to design appropriate learning environments that challenge long-standing curriculum structures through the cooperation of all faculty involved with teacher preparation. Without the purposeful creation of collaborative, authentic, and content-focused learning environments in which future teachers are empowered to develop content, pedagogy, and technology strategies concurrently, new technology standards will be meaningless.

The PUMA Program

The University of Houston (UH) College of Education has a history of providing innovative teacher education programs, grounded in research and effective practice, for urban, at-risk populations. UH is located in the heart of Houston, the nation's fourth largest city, in the Third Ward, an inner city poverty area of Hispanic and African American cultures, which has been identified as a federal Empowerment Zone. Approximately 450 elementary and secondary teachers graduate from UH each year, with minority students constituting 37% of the College's undergraduate enrollment.

The UH teacher preparation program is predicated on a belief of learning throughout the career of a professional educator, beginning with effective preservice preparation and successful entry into the teaching profession. To that end, the Pedagogy for Urban Multicultural Action (PUMA) program was designed to develop new teachers who can demonstrate current best practices, understand the needs of diverse youth within a constantly changing society, and reflect on their own learning and experience. Based at Professional Development Schools (PDS), PUMA provides authentic classroom settings in which preservice teachers can learn and practice effective teaching strategies, while working with university faculty and qualified School-Based Teacher Educators (SBTEs).

The four-semester sequence of PUMA is offered in three phases: Pre-PUMA, Phase I PUMA, and Phase II PUMA. The Pre-PUMA program, the two junior year semesters, includes courses in the theories and practices of effective classroom management, and understanding the psychological needs of learners.. Phase I PUMA consists of a one-semester set of field-based courses that focus on the basic study of the history and philosophy of American education, and the development of professional planning, instruction, and evaluation skills. Phase I preservice teachers are placed at PDS schools to participate in methods courses and classroom placements on alternating days, permitting students to integrate theory directly with practice. Students who successfully complete Phase I are approved for admission into Phase II, a 14-week student teaching/internship placement, in which students demonstrate those sets of knowledge, skills, and attitudes reflective of a beginning professional.

Areas of Need

Despite receiving both local and national acclaim, several significant challenges remain related to improving the coherence of the entire PUMA program through the integration of technology in appropriate ways to meet the needs of our diverse student population. Using an approach grounded in the tradition of community-based action research (Stringer, 1999), we identified key technology leaders in the Houston-area school districts and invited them to identify and propose solutions to these challenges. We believe that for lasting program change to occur, this effort needs to be collaborative, rather than directive from the university perspective. Long-standing collaborative relationships among the 32 schools in the Houston Area Teacher Center served as the foundation of this focused and recursive inquiry and decision-making process. Our plan for program evaluation, rather than being an afterthought external to program activities, is integral to the collaborative decision-making among stakeholders.

As we analyzed baseline data from extensive surveys and focus group interviews of representative participant groups, a set of challenges became clear. The first challenge we face is identifying the best ways to create access to technology among our widely diverse urban student population. Although 73% of our students have home access to computers, only 3% own a portable computer that can be used in flexible groupings with other students and teachers for both campus and field-based coursework.

Another challenge is a lack of coherence and the disconnection between the Pre-Puma courses and the rest of the PUMA program. Little across-course planning among the instructors gives our students the impression that these courses are separate entities - merely a set of academic hurdles, rather than a meaningful sequence of preparation. Furthermore, unlike the highly structured field experiences of PUMA Phases I and II, there is no field-based experience and sparse technology integration in Pre-PUMA. When queried, our students indicated a strong need for accessible networking for communication between campus-based and field-based experiences and resources. The third challenge that consortium members identified is that in our current plan, we address educational technology with a single course taken typically during the Pre-PUMA phase of the program. This placement is not ideal for several reasons, including the fact that such a "one shot," disconnected course does not allow students to see ways in which technology can be seamlessly integrated into content area strategies. When surveyed, UH preservice teachers

perceived the importance of technology, but were unsure as to the benefit derived from the single course currently required. A majority reported, however, that they are rarely required to use technology in any other methods courses.

The fourth challenge facing our college is a lack of faculty confidence and skill with technology. Although data from a faculty survey revealed 100% computer ownership for 5 years or more, actual instructional computer use in the classroom dropped dramatically. A majority of faculty expressed a desire to utilize more technology tools to improve their classroom teaching, however even those faculty members who are technologically proficient express concern about teaching technology strategies in addition to their already very full curriculum. Further, little effort has been made to collaborate with faculty in other colleges across campus that teach preservice teachers prior to acceptance into the PUMA program.

Design for Improvement

Our plans for program improvement emerged from the needs identified by our stakeholders. Those needs led to revised program goals and objectives, which led to proposed actions, anticipated outcomes, and ultimately, multifaceted, interpretive, and participant-focused evaluation strategies. The process we strive to build is an inclusive action research-based model that spirals from our initial need through the stages of *Listen*, *Think*, and *Act*, with the logical subsequent dissemination stage of *Share* to complete the sequence and feed the next spiral in the process. We define *action research* as a systematic process through which stakeholders work together to frame questions about teaching and learning, to problem-solve, to implement proposed solutions, and to document and evaluate the subsequent results of their actions (Stringer, 1999). This process embodies the reflective decision-making among learning communities, which is integral to the PUMA program.

Goals of this Project

Networked learning communities provide collaborative and supportive environments in which preservice teachers share and develop content, pedagogical, and technological expertise.
Learning communities (Fullan, 1999) of preservice teachers, university faculty, and K-12 teachers are in the process of being established to support beginning teachers from initial coursework through induction teaching years. Students entering the PUMA program are invited into these smaller, more nurturing subsets of the larger program, giving immediate support to new members and a virtual place to learn that is available from anyplace and at anytime. More experienced members can offer guidance and insight to new students, while newer students can constantly challenge more experienced members to reconsider previous conceptions. Technology will play an invaluable role by connecting those at various distant locations and asynchronous occasions. All community members have opportunities to learn and practice effective online communication strategies through e-mail, Web-based discussions, video conferencing, and chat. An additional benefit of constructing strong and progressive learning communities is that students can remain in contact throughout the student teaching experience, a time when students often feel isolated from campus colleagues.

All students have access to current-model portable computer technology on a regular, immediate, and flexible basis.
Preservice teachers use computers both as students in university-based courses and as teachers in their field-based classrooms, however we strongly believe that technology will prompt changes in teaching and learning habits only when it is available regularly and immediately for flexible learning opportunities. We consider laptop computers to be the most effective way to encourage spontaneous learning anywhere at any time. In fall 2000, wireless hubs were installed in classrooms through the College of Education building. Three 10-unit mobile, wireless, laptop stations were purchased for use by PUMA faculty and Technology Fellows in campus-based courses in conjunction with the hubs in any classroom in the building. Our goal is for students to regularly experience the versatility of portable computers, thus creating an understanding of the need for portable computers in their learning and teaching. PUMA admissions guidelines for school year 2001-2002 will require the lease or ownership of a laptop computer; reasonably-priced laptops with accessible leasing and financing plans will be made available to students through COE relationships with relevant business partners.

The College offers a comprehensive, connected and extended technology experience.
To provide an environment, in which our future teachers can come to see the appropriate and exemplary use of technology in education, we have implemented structural changes to our technology component. We have

restructured our current three-credit hour required technology in education course into three one-credit-hour sections to be taken over the three-semesters leading up to the student teaching experience. Campus-based students are exposed to technology appropriately in methods courses, and also attend a one-hour weekly lab to reinforce content-related technology strategies, while field-based PUMA I and II students will receive site-based workshops and electronic support. PUMA I students will additionally be placed in classrooms with identified technology mentors when possible, and when not, will have access to technology mentors within the district. By extending the exposure to technology interwoven with pedagogical strategies, we believe our preservice teachers will more thoroughly integrate technology into their future teaching.

Students have comprehensive and coordinated opportunities to develop standards-based technology proficiency.

Entering PUMA students will be required to demonstrate basic technology proficiency, so that efforts during PUMA can focus more effectively on the use of technology in instruction, rather than taking precious time to instruct on basic operations. Recommendations for such general preparation for students is found in the new ISTE NETS standards (ISTE, 2000), and we have found, as have others (Kirby & Schick, 1998), that students are now entering preservice programs with some experience with basic word processing and communication technologies. To ensure that students possess general technology skills sufficient to participate in the program (Rodriguez, 1996), their skills will be assessed through a performance-based pre-test. Those who are lacking the required skills will have ample opportunities to develop basic skills prior to PUMA admission through a series of topic-specific workshops, recommended courses, and other support. Throughout PUMA, students see and use various technologies, in the context of methods strategies, to reinforce basic skills, personal and professional productivity, and effective instruction.

Students compile and maintain electronic portfolios throughout their preservice experience.

While traditional grades are still required by the university, an electronic performance-based portfolio system has been established to allow students a venue through which to reflect on and demonstrate growth, the development of pedagogy (Carroll, Potthoff, & Huber, 1996), and a professional voice (McKinney, 1998). Portfolios have been shown to be a flexible assessment format capable of addressing criteria not a part of traditional assessments, such as continuous student reflection, individual assessment of growth and change, iterative evaluation of learning goals, and the contextual examination of created products in relation to complex teaching processes (Levin, 1996; Snyder, Lippincott, & Bower, 1998; Wade & Yarbrough, 1996). Not only will portfolios give students an authentic example of assessment that they might use in their own teaching, but students will graduate with a tangible record of their experiences and a better understanding of their own abilities. Students might also include representative examples of work produced by the students they teach (Hoelscher, 1997). Faculty and Technology Fellows will work with students to design content products that reflect both discipline-specific and technology standards. Students will receive instruction on technical procedures, style guidelines, and ethnographic strategies for selecting representative examples their own work.

Virtual field experiences are being developed for campus-based students.
Unique campus resources are being developed for field-based students.

Video experiences are being developed to provide campus-based methods instruction with real classroom contexts. A collection of virtual field experiences using a variety of traditional and emerging video technologies is being developed, implemented and evaluated. Methods and IT faculty are in the process of identifying exceptional teaching and technology integration examples in collaboration with SBTEs. IT graduate students and staff are collaborating to plan, record, prepare, and compile high-quality video scenarios for use in on campus-based classes and in online training. While preservice teachers participating in the field-based PUMA programs benefit greatly from being immersed in authentic classroom settings, there are instances when the widely distant PDS locations prove problematic. It is difficult, for example, for certain expert speakers to regularly travel to all field sites. Certain courses deemed unique and valuable will be taught to students in the field by campus-based experts through technologies such as video, online streaming video, videoconferencing, and web-based communication. IT graduate students and staff are collaborating with faculty experts to plan, record, and prepare the presentations.

Faculty and students are participating in new models of teaching and learning for the purpose of developing technology proficiency.

Faculty are being assisted in developing skills and confidence in appropriate uses of technology for content areas through short workshops during the semester, and intensive workshops during intercessions, summer, and weekends.

Handler and Strudler (1997) suggest a collaborative process in which content methods faculty work with instructional technology faculty to align content strategies and resources with technology standards using a matrix technique. We feel such a collaborative alignment process not only capitalizes on our faculty's full range of expertise, but helps to establish our collective meaning of technology integration for everyone involved with teacher preparation at the University of Houston. Faculty also have opportunities for continued support through the Academic Technology Support Center (ATSC), being developed to provide all UH faculty with training and support to enhance teaching and learning with new technologies.

Of prime importance to the success of this program is the one-on-one collaboration that PUMA faculty have available from Technology Fellows, who are Instructional Technology graduate students specially trained in such skills as content-area technology integration, mentoring, and adult learning theory. Similar to student-faculty mentoring plans proposed by others (Sprague, et al., 1998) Technology Fellows collaborate with and support PUMA faculty members in content areas to identify technology strategies that can be used to teach and demonstrate content-related concepts, to assist with set up and operation of necessary technology, and to generally help faculty gain confidence in their own personal technology skills. In addition, Technology Fellows are accessible to students in campus-based methods courses, during weekly computer lab workshops, and electronically via e-mail. After the first year, the Technology Fellows will commute to PDS sites with the PUMA students to maintain consistent student contacts, ensure properly functioning technology, and facilitate university-school relationships onsite. Completing our learning community concept, such relationships make a school-based learning environment feasible and at the same time give our IT graduate students valuable experience in authentic teaching environments.

Ongoing Assessment of Program Success

These program change efforts were designed to increase the technological readiness of future teachers through an action research-based process. We recognize that any changes to our current program will also simultaneously cause other, unintended changes, both welcome and otherwise. To monitor and continually adjust our efforts, we have developed an evaluation plan to address both process and product outcomes according to our inclusive action research approach. First, we established baseline data by having preservice teachers, university faculty, and SBTEs complete a questionnaire on attitudes toward technology, use and perceived skill, and learning style with technology. Technology representatives from consortium school districts participated in focus groups to identify needs and propose solutions. Data from these multiple forms of needs analysis will be used to provide baseline data. Then during the first year of this program, working with action-research consultants and through a collaborative stakeholder effort, we will identify more in-depth, qualitative assessment strategies to reassess the need and the strength of our research process. In our action research-based framework, formative evaluation is a key and ongoing process that will involve all stakeholders.

To ensure that the program is progressing toward the goals, we will: (1) ensure that national and state standards concerning content, pedagogy, and technology integration are met; (2) demonstrate that program curriculum supports the standards; and (3) base student assessment on the standards, through state assessment instruments (EXCET test) and local assessments, such as rubrics (developed collaboratively by preservice teachers, faculty, and the evaluation team). Questions to be considered during formative assessment will also be derived directly from program goals and outcome measures, as well as identified through ongoing community-based collaboration with consortium members. The process itself will be repeatedly assessed so that it accurately represents stakeholder needs, interests, and strengths. We consider this unique teacher preparation approach ideal for the longitudinal study of the development of pedagogical skill and technology proficiency of new teachers. The rich context will support numerous research projects, yielding data from a wide range of procedures and instruments, including questionnaires, performance assessments, examination of student- and teacher-produced products, learning and teaching journals, observations, interviews, focus groups, video and audio recordings, anecdotal records, and open-ended critiques. Other data will include course syllabi and evaluations, documentation of professional development and support available to PUMA faculty, documentation of support provided to PUMA students, archived electronic communication, and databases of instructional resources. Finally, we plan to follow our graduating teachers out into the field to assess the effect such a comprehensive preparation program has on their ability to effectively teach in 21st Century classrooms by collecting state ExCET scores, electronic portfolio rubrics, and teacher evaluations at the end of the induction year.

Conclusion

Our program was redesigned to include several critical factors for success. The use of an action research approach ensures that progress towards goals and objectives will be continually assessed and evaluated. The purposeful creation of collaborative, authentic, and content-focused learning environments in which future teachers are empowered to develop content, pedagogy, and technology strategies concurrently is a critical factor in the design of preservice teacher education programs. Modeling strategies for accomplishing objectives by using technology for instruction is a significant part of the instructional process, addressed through a variety of professional development opportunities for both faculty and preservice teachers. Finally, technical support is available both for on-campus courses and field-based experiences. The University of Houston's history of innovation and leadership in teacher education, as well as on the close working relations established with relevant stakeholders committed to improved education of urban, low-income, at-risk children and youth, gives us great optimism that these program improvements will have tremendous potential for long-range, systemic reform.

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